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TELEPHONIC GROWTH.

Our issue this week devotes even more space than usual to telephonic matters, this being a season when the breaking up of frost invites to new construction so that subscribers can be added and toll lines run. Any one can see from the news presented that the field is in a condition of great activity. An even better feature is the determination of the independents to improve their work and service, so that to be "as good as the Bell" no longer expresses their ambition to the full. Whatever may be the outcome of the present rivalry and activity which has surpassed anything seen hitherto in telegraphic or telephonic work, and which equals the fervor of the old trolley days, it is clear that a large amount of work remains to be done before the country is adequately supplied with telephones. While some communities may suffer from too much telephone, the great majority of the inhabitants of the United States still suffer from too little.

THE RUSSIAN TARIFF.

It is very discouraging to find that just as an excellent electrical trade with Russia was springing up, a dispute over a few poods of sugar should threaten to choke it off, with a vast amount of other American export business in products of metal. Looking over the figures given weekly in our columns of shipments through the port of New York, we find that while electrical exports to Russia in these lines were less than $7,000 in the first half of 1900, they ran up to nearly $70,000 in the second half. We know from the responses to our own efforts to push such Russian trade that it is growing rapidly this year, and it is therefore to be profoundly hoped that no check will now be imposed by the present dispute over sugar rebates. There are signs that Russian opinion favors the removal of such misunderstandings, and the maintenance of all friendly commercial relationships. As we have ventured to say before in these pages, American trade must come more and more to a basis of reciprocity, and here is a chance to put ourselves right with Russia, with whom our interchange of products ought to be much greater now than it has ever been before.

NUT CRACKING BY ELECTRICITY.

Attention has recently been called to the fact that annually in St. Louis several thousand tons of nuts are cracked electrically. We hardly see why this should excite wonder, for the great role assigned to electricity nowadays is that of cracking nuts of every kind. If there is any old or new difficulty in physics or mechanics, resort to electricity is immediately suggested, and where every other agency has failed, there is still thought to be some hope, if only the electrical inventor can be induced to turn his mind to the subject. This, indeed, must be offered as a good excuse why modern electrical inventors are generally so diffuse in their efforts and cannot be pinned down long to any one problem. Opportunities to win new triumphs present themselves so abundantly in every direction that the most enduring energy and the highest genius are in danger of dissipation without net results.

This is the reason why the public once in a while gets impatient with the inventor and says rude things; or, as the New York *Sun* puts it neatly, in defending its worthy protégé, Mr. Tesla, utters "flippant remarks of disparagement." The tide of this flippant disparagement has been rising high of late, possibly because Mr. Tesla, with the onrushing enthusiasm of a man who sees things ahead to be done

and is fertile in expedients for doing them, inclines to discuss them as though they were already disposed of. With men of this stamp of intellect it will be so to the end, and it would be a prosaic world of mediocre achievement if it were otherwise. Just at present Mr. Tesla and his brilliant fellow-countryman, Dr. Pupin, have their names associated in the public mind with new means of communicating across the ocean, and the newspapers, as the popular sources of scientific information, are full of the subject—a thing we heartily prefer to seeing the same columns filled with murder cases. But it is certain, in advance, that before they get through, both Messrs. Pupin and Tesla will encounter a good deal more of "flippant disparagement." What is now being heralded as a novelty in each instance has been known to the electrical community for some time past, as we show in reproducing our articles of nearly a year ago; and probably before the goal is reached there will be several successive outbursts of sensational writing, followed by more of the "flippant disparagement." Obviously the tasks of telegraphing to Europe without wires or telephoning to Europe with a "loaded" cable are most serious problems, but the public is impatient, we fear, and does not realize that things attempted these many years past may still linger unaccomplished many years to come, without any fault on the part of the men who do not "get there," strive as they may.

In Mr. Tesla's case the injury done him by the jokes and jibes one finds in almost every paper picked up is the more severe because so much is promised in his name without his direct personal sanction. There seems no way to stop this abuse of confidence, from which Mr. Edison has also suffered to such an extent that a shotgun is his preferred reception for the average reporter. But just now Mr. Tesla holds the center of the sensational stage, and the talk about him is all the looser for the reason that it has so little that is tangible behind it as food. He has read no scientific papers before the societies for years, and since his monumental series of patents on polyphase work has taken out extremely few patents. We can recall only one or two in recent years. Hence, the gossip that always besets a great genius has little to feed upon save the wild and absurd stories to which few of the authors hesitate even at signing Mr. Tesla's own name. In this way, as all such men discover, the lot of the genius trying to crack the nuts of modern civilization is not much better than that of his predecessors treated as lunatics or witches. And this "flippant disparagement" falls hardest upon those who are not drawing-room inventors with drawing-board inventions.

The Latimer Clark Electrical Library.

Possibly the last opportunity now offers to secure for this country the magnificent library of the late Latimer Clark, and it is to be sincerely hoped that some friend or friends of the American Institute of Electrical Engineers will obtain the collection for that body. As in the case of the great Ronalds collection, now owned by the English Institution of Electrical Engineers, so much stress has been laid on the literary rarities which the Clark library contains, that its great value from a utilitarian standpoint has perhaps been overlooked. As a reference library it is almost absolutely complete in English titles up to the present period, and includes possibly every work of real reference value that has been printed in continental tongues.

Those who have occasion in this country to look up important references relating to the early days of electricity are greatly handicapped at present by the almost complete lack of access to originals or even to works of any kind printed earlier than a quarter of a century ago, and this condition is naturally reflected in our literature when it touches upon the historical side of the electrical art and science. For the past few years the American Institute of Electrical Engineers has been paying especial attention to the matter of a library. Its collection now numbers more than 1200 volumes, and as these consist largely of bound volumes of periodicals, the library has already a real importance. Were the Clark collection added the library would at once assume a standing worthy of the Institute, one which would attract to it gifts and legacies from the membership, and assure its future. We must confess to a keen desire that the present opportunity should be availed of, and venture to believe that among the Institute members to whom the growth of the science and art has brought some measure of worldly fortune, the needed generosity will be found to effect this lasting good.

State of Physical Science at the Beginning of the Century.

In our review columns will be found a notice of the recently issued report of the International Physical Congress held at Paris last year —a work which offers such a notable contribution to the literature of physical science that we desire to direct to it the especial attention of such of our readers as are conversant with the French language. Of the 80-odd papers contained in the three volumes more than 30 relate to electrical or closely allied subjects, including a collection of monographs on electrical discharges in gases, on ionization and radio-active phenomena, which will be of particular value to the reader who wishes to thoroughly inform himself concerning these comparatively recently developed branches. Aside from the authoritative character of the papers contained in these three portly volumes due to their coming from the pens, with scarcely an exception, of recognized leaders in physical science, their plan is such as to greatly heighten their value. This plan, as followed in most of the papers, is to give a résumé of the branch treated to date, followed by a discussion of its latest developments and present status, and concluding with a forecast into the future. The work thus forms an authoritative record of the state of physical science at the beginning of the century, and furnishes an admirable starting point in taking up the study of any of the branches represented in this remarkable collection of papers.

Discontinuities in Magnetic Declination.

In the Annuaire of the Bureau des Longitudes for 1901 and also in the same volume for preceding years, is a set of small charts showing the declination, inclination and horizontal magnetic force over the surface of France. The mean horizontal intensity is about one-fifth of one gauss with the isodynamics running roughly east and west, and fairly parallel to one another. The mean dip is in the neighborhood of 64 degs., and the isoclinics also run roughly east and west, also sensibly parallel to one another. The mean variation is about 15 degs. west, and the isogones run roughly north and south, parallel to each other, except in a certain region in the north of France where the lines are contorted in a pair of very sharp bends. A straight line joining Nevers on the Loire, with Dieppe on the British Channel, and passing nearly through Paris, approximately follows the course of this remarkable distortion, which might be termed a fault in the veins of magnetic declination. The magnitude of the disturbance amounts at its greatest to about half a degree, so that an observer traveling north and following an isogone would first swing suddenly about 30 miles eastward, then return suddenly to the regular course and again swing sharply 30 miles westward before resuming his steady march. This distortion is barely noticeable on the inclination and horizontal intensity charts. If a feeble vertical electric current sheet intersected the land, and pointing upwards, it might have such an effect as is indicated, but, of course, it is difficult to see by what force a vertical electric current sheet could be maintained, following this line nearly 200 miles long. The distortion is noted in the description of the charts, but no explanation for it is offered. It is stated, however, to extend northwards across the channel into England as far as Oxford. It is quite evident that there

exists in this enigma a most interesting inquiry, although its source may be very deep.

The whole subject of terrestrial magnetism is still enveloped in mystery. In the year 1600, or 300 years ago, the agonic line, or line at which the magnetic needle pointed north and south, passed through Turkey and eastern Germany. Now it passes nearly through Cincinnati, Ohio; but, although this agone has apparently passed one-third of the way round the world in this time, yet its movement has been so irregular, and its position at intermedite dates so contorted, that it seems impossible to explain the change as a revolution of magnetic poles within the substance of the earth. The facts seem to suggest rather a periodic waxing and waning of polar areas or polar forces.

THE TEMPERATURE CO-EFFICIENT OF RESISTANCE IN METALS.

One of the most remarkable properties of metals in common is found in the temperature co-efficient of their resistivity. Thus, aluminum, copper, silver and gold have resistivities varying roughly in the respective proportions of 29, 16, 15 and 20, yet their temperature co-efficients of resistivity are all approximately 0.4 per cent per degree Centigrade reckoned upon the resistivity at zero Centigrade as standard. It is wonderful that this co-efficient should be so nearly alike in these different cases. The temperature co-efficient of copper, for example, is so nearly uniform in samples of commercial copper wire, that it forms the basis of practically determining the temperature elevation of dynamo-electric machines under load. The temperature co-efficients of tin, lead, magnesium, antimony and bismuth are all nearly the same as that of copper, and the same may be said for mercury in the solid or frozen condition. Iron forms a notable exception, being distinctly higher (0.46) while liquid mercury is only about one-fifth of that of copper, so that its change from the solid to the liquid state reduces its temperature co-efficient some five times. Carbon, having a negative co-efficient, is perhaps the most remarkable of conducting substances in this respect.

As a rough generalization, it is, therefore, fair to say that all of the solid metals, except iron, have a temperature co-efficient in the neighborhood of 0.4, and this variation appears to follow substantially a straight line law from the lowest to the highest observed temperatures. At first sight, platinum seems to constitute an exception to this rule, being usually stated at about 0.25, but the fact of the difficuly of obtaining platinum free from alloy may, perhaps, account for this discrepancy. In the face of a common property so remarkable as this, no theory of electric conduction can possibly be complete without offering a satisfactory explanation for it.

THE STUDY OF ELECTRICAL ENERGY.

We often wish that some of the active students of electrical theory, upon whose acutely directed activity so much of human progress depends, could be provided with a species of intellectual ball and chain to encourage contiguity with mother earth. Not that we would wish to repress theory and hypothesis with the wearying clog of things purely practical, but we would like to impress the restraining influence of every-day facts upon flights of the scientific imagination. And chiefly we wish that every man who writes papers upon electrical topics or who is tempted to that indiscretion would remember first, last and always that the thing with which the experimenter deals is in every case a manifestation of electrical energy. One of the first things taught the schoolboy in science is that "electricity is not a form of energy," a statement which in itself admits of no dispute, but which in nine cases out of ten conveys a totally wrong impression. All that we know of "electricity," however, we gather from experiments on the electrical energy of which it is an indeterminate and perhaps physically inconsequential part. Whatever we may do with mathematical symbols as a matter of convenience, the facts by which these symbols are brought into physical significance have to do with electrical energy. We need a new Joule to free electrical science from its incubus of metaphysical quantities and put the theory of electrical energy upon a sound basis. We have had plenty of Fouriers, who have accomplished splendid things in electrical theory, but never a Joule to bring their works to fruitfulness. We cannot get along without the mathematicians, but every little while in the world's work comes a time when there is bitter need of a great experimenter and scientific logician like Faraday or Joule.

When we see the high-tension line of a big transmission plant at night glowing blue with the energy that is streaming off into the dielectric and delivering perhaps a thousand kilowatts to the distant transformers, discussions as to ionic charges in a conducting medium lose their significance in face of the great fundamental fact that here is a wire no bigger than a leadpencil along which is being delivered enough energy to light a whole city. The all-important question is the relation of this particular form of energy to the mechanical energy whence it has been transmitted, and the luminous energy into which it is destined to pass. Cut that metallic thread and the spell is broken and a city plunged into sudden darkness. All the theories of electric and electromagnetic induction that have ever been formulated are as yet helpless to explain the wonderful thing that has become part and parcel of our daily life. They do not go to the root of the matter, they deal with concomitants rather than causes. It may be that the nature of electrical, and for that matter thermal, energy belongs in the category of the unknowable, but we have no right upon that assumption to neglect all investigation of the matter. Or, look at the subject on a smaller scale. Here is an electrical condenser, a little pile of mica and tinfoil, in which is stored enough energy to knock down a strong man at the touch of his fingers. To say that the plates of this condenser are charged with positive and negative electricity is utterly futile; it is merely explaining by definition. In point of fact, we know that energy has somehow been stored in that inert and harmless looking dielectric just as really as energy in another form is stored in a dynamite cartridge. That this electrical energy produces somewhat striking phenomena at the surfaces of the energized body is in nowise remarkable, although in itself interesting enough, but why these surface conditions deserve a special nomenclature, and why all the essential facts should be reduced to terms of these phenomena alone, is from a philosophical standpoint quite incomprehensible.

In some particulars, it is true, modern investigators have tried to escape from such a narrow point of view, and to consider electrical energy in its broader aspects, but they have only made a beginning. Even now nearly all the text books begin the discussion of electrical matters along the ancient line followed when a ball of brimstone and the discarded hide of a defunct tabby cat were the most formidable dispensers of the electrical fluid. The vitreous and the resinous electricities are still with us in spirit and will not down. They are the stumbling block of many a hapless student, who does not escape from their malign influence until in dealing with the tremendous agents of modern electrical engineering he finally realizes that there is a vast difference between the substance and the accidents of electrical science. We would not dispense with any part of that science, nor belittle careful investigations, however unpromising of practical results; but there is much in our present electrical theory which should be studied and perhaps rewritten from the standpoint of energy, not for its practical so much as for its theoretical value. Electrical text books in particular ought to be provided taking a broader view of the subject than those now current.

Latimer Clark Library.

We learn that the magnificent library of the late Latimer Clark is now being offered for sale in this country. The library embraces about 4000 bound volumes dealing with electricity, besides more than 2000 pamphlets and periodicals, and also many photographic and autographic albums constituting an almost complete collection of the portraits and handwriting of eminent electricians.

A man of Latimer Clark's scientific attainments and literary tastes naturally found it congenial to surround himself with all obtainable publications and other data bearing upon his own very extensive researches in the electrical field, and it is not surprising to find that his library embraces pretty much all of the reference literature touching upon the leading scientific inventions and discoveries of the nineteenth century. The prominent positions held by Mr. Clark as president of the Institution of Electrical Engineers, and as an officer in other professional and scientific bodies, during the tenure of which he gained much popularity, gave him unusual opportunities for acquiring valuable literary material as well as autographs and photographs of celebrities, which he fortunately availed of.

The value of the pamphlets, in particular, may best be judged by the fact that several of them each cost their late owner, more than 10 years ago, as much as £20, which figure at the time exceeded even the cost of his fine folio vellum copy of Martin Cortes, "Breve Compendio de la esfera y de la arte de Navagar," 1551, edition of 190 pages, one of the treasures of the collection.

In a letter to a friend in New York, and referring to Mottelay's "Chronological History of Electricity" (printed in these columns some years ago), Mr. Clark says: "It was quite a treat to me to read over the 'History,' and to see what a large proportion of the rarities I had in the original. Of course, in all the more modern works up to 1889, it is practically complete. * * * I find also that I possess in my library by far the greater number of the very ancient works which Barnalite has cited in his researches on Peregrinus, so that I had the chance of consulting the actual works as I read the references to them. In this respect my library is incomparably richer than the Ronalds library; in fact, is a far finer collection than the Ronalds. During the first 30 of the 40 years I was collecting, I secured every electrical book that was published in England (including pamphlets), besides all I could hear of that were published in foreign languages. I was so lucky, too, in digging out the old books that I can nearly boast of possessing every English work on the subject up to about 1886 or 1888, after which they became painfully numerous. I have all the few very scarce and interesting sixpenny and shilling pamphlets which appeared when the telegraph first came into existence—they are now extremely rare. I have also, I think, all the scarce old histories and treatises on the magnetic needle by English and foreign writers—some very interesting."

In the way of absolute rarities, the Clark library exceeds by far that collected by Sir Francis Ronalds, and which is now owned by the English Institution of Electrical Engineers. Among them may be enumerated, in addition to the 1551 Cortes named above, a 1473 Vincentius (Bellovacensis); the 1478 and 1490 Sacroboscos; the 1491, 1513 and 1519 Albertus; 1510 Leonardus; 1519 Glanville copy of Lord Stuart de Rothesay; 1528 Homer; 1531 Marbodeus; 1535 Stoefler; 1537 Mardus; 1541 Raimondi Lulli; 1545 Pontano; 1545 Apianus; 1546 Polandus; 1547 Proclus; the extraordinarily rare 1558 Peregrinus; half a dozen Portas; the Taisniers of 1559, 1560, 1562; the 1562 Ptolemai; the 1585 and 1592 Bororigh; 1581, 1592 and 1720 "Neuie Attractive"; Ridley's Magnetical Bodies, 1613; 1597 "Navigator's Supply"; 1613 and 1616 "Magnetical Advertisements"; all the Gilberts and the works of Cabeus, Kircher, Guericke, Newton, Volta, etc., etc., including the original and excessively rare four-page quarto pamphlet wherein Oersted announced to the world his discovery of the influence of the galvanic current upon the magnetized needle, and also the extremely rare copy of George Green's "Mathematical Analysis of the Theories of Electricity and Magnetism," issued in 1828. Of works on the sympathetic telegraph, Mr. Clark exhibited 34 different editions, at the Paris International Electrical Exposition of 1881.

The Clark collection has been valued at $20,000, but can, we learn, now be purchased for less than half that sum. It is to be hoped that some public-spirited American citizen will try and obtain it for this country, and not let it go, as it easily might, into the hands of Japanese and German representatives of electrical associations, who have, it appears, cast upon it longing glances for a long time past. Mr. Clark at one time remarked that he should like the library upon his death to come into the possession of the American Institute of Electrical Engineers, the English Institution of Electrical Engineers being the possessor of the great Ronalds collection.

Forecast of the General Electric Annual Report.

Last week witnessed one of the most phenomenal advances in electrical securities in the rise of General Electric to 217, settling at the close to 211, a net gain for the week of nearly $15 per share. The price of the stock had already gained rapidly of late and was generally regarded as high, but it is stated that the conditions are such as to warrant even these latest figures. As might be expected, Wall Street is full of rumors as to what may happen.

A well-known brokerage house, Harrison & Wyckoff, in a circular on General Electric, notes that nearly $4,000,000 of the debentures of the company have recently been exchanged for the company's common stock on a basis of $120 of debentures for $100 of stock, leaving only $1,693,100 outstanding. The fixed charges of the company are only the interest on the debentures, $84,655. The interest on the preferred stock is $178,584, so that the charges ahead of the common stock are only $263,239. Earnings last year were approximately $27,000,000, as against $22,000,000 the previous year, $15,000,000 in 1898, and $12,000,000 in 1897. The current liabilities will amount to $1,000,000, against cash on hand amounting to $1,500,000. During the past five years about $8,500,000 of patents and plants were written off and charged to operating expenses, leaving practically no obligations of this character. Orders for over a year in advance are reported to have been booked.

It has been rumored that the directors might give back to the stockholders the stock they lost when in 1899 a reduction was made of 40 per cent. The present stock outstanding is $2,551,200 preferred and $22,836,000 common; total, $25,387,200. But it is said, on the other hand, that in all probability the General Electric board will not reopen the capital account of the company in the future and there will be no stock dividend. It is more likely to choose the other method of distributing profits, viz., that of paying them in periodical dividends. This will mean very large writing off of profits made last year.

Assuming that the gross business of the company last year was $30,000,000 (against $22,379,463)—which is said to be not far out of the way—the company's earning capacity is not less than 30 per cent on the stock. But it is certain that the management of the company, remembering the terribly bitter experiences of the last hard times, will not be in a hurry to pay out all its net earnings in dividends at any such figure.

Steam and Trolley Traffic in Massachusetts.

Previous to 1893 the steam roads reporting to the Massachusetts Railroad Commission made great gains in their passenger business. From 1890 to 1893 the steam roads reported an increase of 21,000,000 passengers, and the street railways 46,000,000. With 1901 the influence of the improved trolley system began to make itself felt in stimulating street traffic. The annual reports of the Massachusetts Commission give the following comparison of the passenger traffic of the two systems for 1891 and 1900, in which it is shown that the rapid growth of the steam roads from 1891 to 1893 was lost.

The comparison is as follows:

	Steam Roads.	Street Railways.
1891	107,271,000	172,000,000
1900	108,768,000	395,000,000
Increase	1,517,000	223,000,000

Moreover, in 1891 a number of important roads that are now included in the 1900 report of the steam roads were independent railroads, in New Hampshire and Connecticut, and at that time were carrying millions of passengers that should be included in the totals of the steam roads for 1891. If these figures were accessible it would be shown that the number of passengers carried by the steam roads was decidedly smaller in 1900 than in 1891.

Again if a comparison was to be made of the growth of the surface roads that compete with the steam roads the increase in the traffic of the surface roads of Rhode Island, Connecticut and New Hampshire from 1891 to 1900 should be added to the increase of 223,000,000 shown above as the increase of the Massachusetts street roads alone since 1891.

The Independent Telephone Exchange at Rochester, N. Y.

FIG. 1.—ROCHESTER TELEPHONE EXCHANGE.

ONE of the best constructed and most modern equipped telephone exchanges in this country is the independent telephone plant now in operation in Rochester, N. Y. The company is a local organization, and was organized about two years ago. It has as its stockholders some of the wealthiest and most influential business men in Rochester. The officers of the company, all having large other interests, placed the entire work of building the plant in the hands of C. E. Stinson, formerly superintendent of the Bell exchanges in that section. The construction department, the most important—especially during the time of building the plant—was placed under the charge of Mr. C. O. Harris.

The first work was to make detailed specifications of the entire system proposed, maps of the aerial and underground construction, and an estimate of all material required. This work was completed and all orders placed for the material and apparatus early in June, 1899. The exchange was completed, and the plant was started with 2500 subscribers the following May. The building shown is owned by the company, and was built especially for the company's exchange and offices. The cables enter the basement through conduits, and are terminated in fused iron terminals. In the basement of the building, beside the terminal room are located the boiler room, a large storage room and a room for shop purposes. On the ground floor are the general offices, the directors' room, superintendent's office, engineering department, the construction department with a stock room accessible from the driveway, inspector's room and the trouble department. In the rear of the ground floor is a battery and distributing room in which are placed distributing board, lightning arrester board, ringing generator, charging machines, storage-battery plant, power switchboard and necessary equipment for making tests of subscribers' instruments for lines. The entire second, or top, floor is occupied by the operating department. The operating room is lighted by large windows on all four sides and by a skylight the entire length of the switchboard.

The equipment was furnished by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, and is of the "central energy" type. The switchboard is located in a straight line on one side of the operating room. It has a capacity for 3600 subscribers, and was originally equipped for 3000 lines, and later equipped to its full capacity. It is a strictly multiple board. Each operator is within reach of every subscriber's line in the exchange, and can complete the connection between any two subscribers. When the subscriber takes the receiver from the hook, a signal is automatically raised into view, showing the number of the station called. The visual signal is automatically released and restored when the operator inserts the plug to answer the call. The connection is made in the usual manner. The clearing-out lamp signal on the plug shelf between the cords is automatically shown when the subscribers replace their receivers, and disappears when the disconnection is made. All signals are made and restored electrically.

On the opposite side of the operating room are the manager's desk, monitor and supervising operator's desk. The supervising operator's desk is provided with a complete operator's telephone and three sets of miniature lamps for each operator's position of the main board, one giving a white light as pilot lamp. and is lighted when a subscriber calls "central" and remains lighted until the operator answers by inserting the plug. A red light shows when the subscribers replace their receivers and remains until the disconnection is made. When the operator rings a subscriber a green light is shown on the supervising operator's desk. This enables the super-

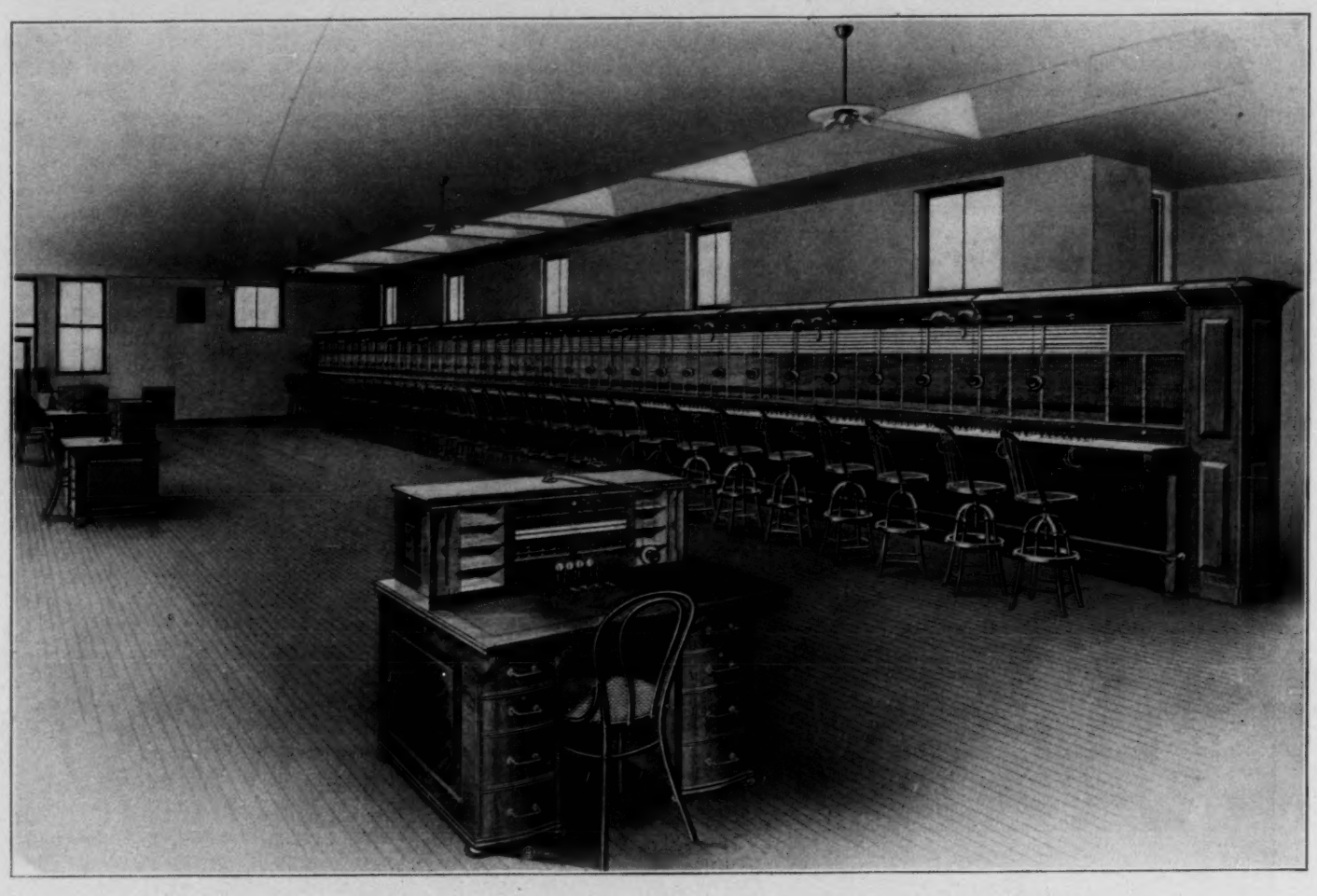


FIG. 2.—INTERIOR VIEW OF ROCHESTER TELEPHONE EXCHANGE.

vising operator to know readily every call received at the switchboard and the time required by each operator to answer calls and make disconnection after the clearing out signal is given. The desk in the center, the monitor, is provided with a pilot lamp for each operator's position, and is connected direct with the various offices in the building. The first desk shown is the manager's desk. This desk is connected

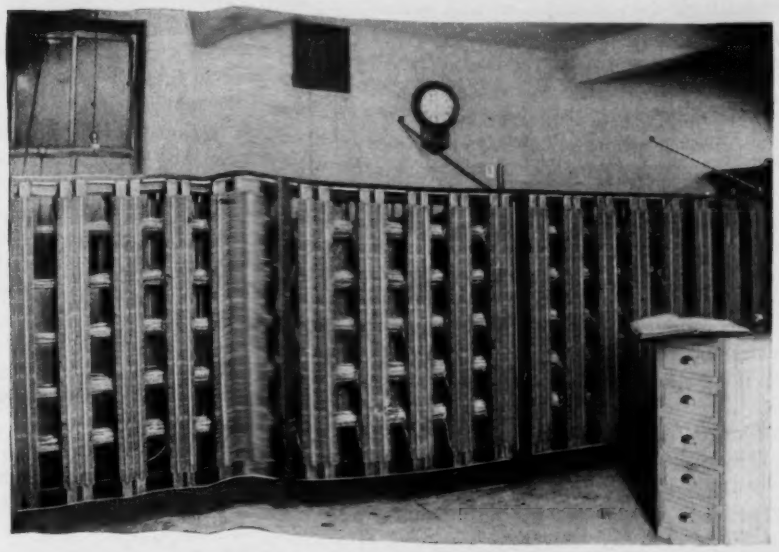


FIG. 3.—CROSS CONNECTING BOARD.

with the monitor and supervising operator's desk, superintendent's office and the various departments, and also has a monitor to each operator's position.

The battery plant consists of two sets of 20 cells, 360 ampere-hour storage batteries. Each set is of sufficient capacity to supply energy for the exchange for over 24 hours. In Fig. 4 are shown the power switchboard, the main and auxiliary charging machines and one of the ringing machines. On the power board are placed the ammeter and voltmeter, the bus-bars with separate fuse for each operator's position and a voltmeter switch, switch for ½-hp ringing machine with starting boxes; switches and starting boxes for the main and auxiliary charging machines, switch and starting boxes for the emergency ringing machines; the field regulators for the main and emergency charging machines, the main battery switch, which is located in the center, the emergency battery switch and the emergency ringing machine switch. The power board is of heavy marble.

The construction work of the exchange is of the highest standard, metallic circuit throughout. In outside construction for the distributing poles, a cable is led from the underground ducts to the top of the pole into an iron terminal, far above all other wires, and the circuits are distributed from a circle pole top by heavy twisted rubber covered wire to the subscribers' instruments.

The company has successfully installed without an accident nearly 200,000 ft. of underground cable through the conduit of the Rochester Gas & Electric Company, which is occupied by both high and low tension currents from 50-volt direct to 2500 alternating.

European Types of High-Tension Alternators—VI.

By C. F. GUILBERT.

GRAMMONT ALTERNATOR.

A GRAMMONT alternator (Figs. 53, 54, 55 and 56) exhibited at Paris, direct-connected to a Piquet engine, was particularly interesting on account of the special system of excitation with which it was provided, designed to maintain the voltage constant at the binding posts whatever the current output or the difference of phase between current and voltage. The exciter, the invention of M. Maurice Leblanc, is based on several interesting principles, of which the most important is the employment of rotary fields in excitation. This method of compounding may be explained quite simply as follows:

Referring to Fig. 58, let $O\,A$ equal U be the difference of potential at the terminals of an alternator, and $O\,I$ the direction of the current generated by the machine and differing in phase from the voltage at the terminals by the angle ϕ. For the sake of simplicity,

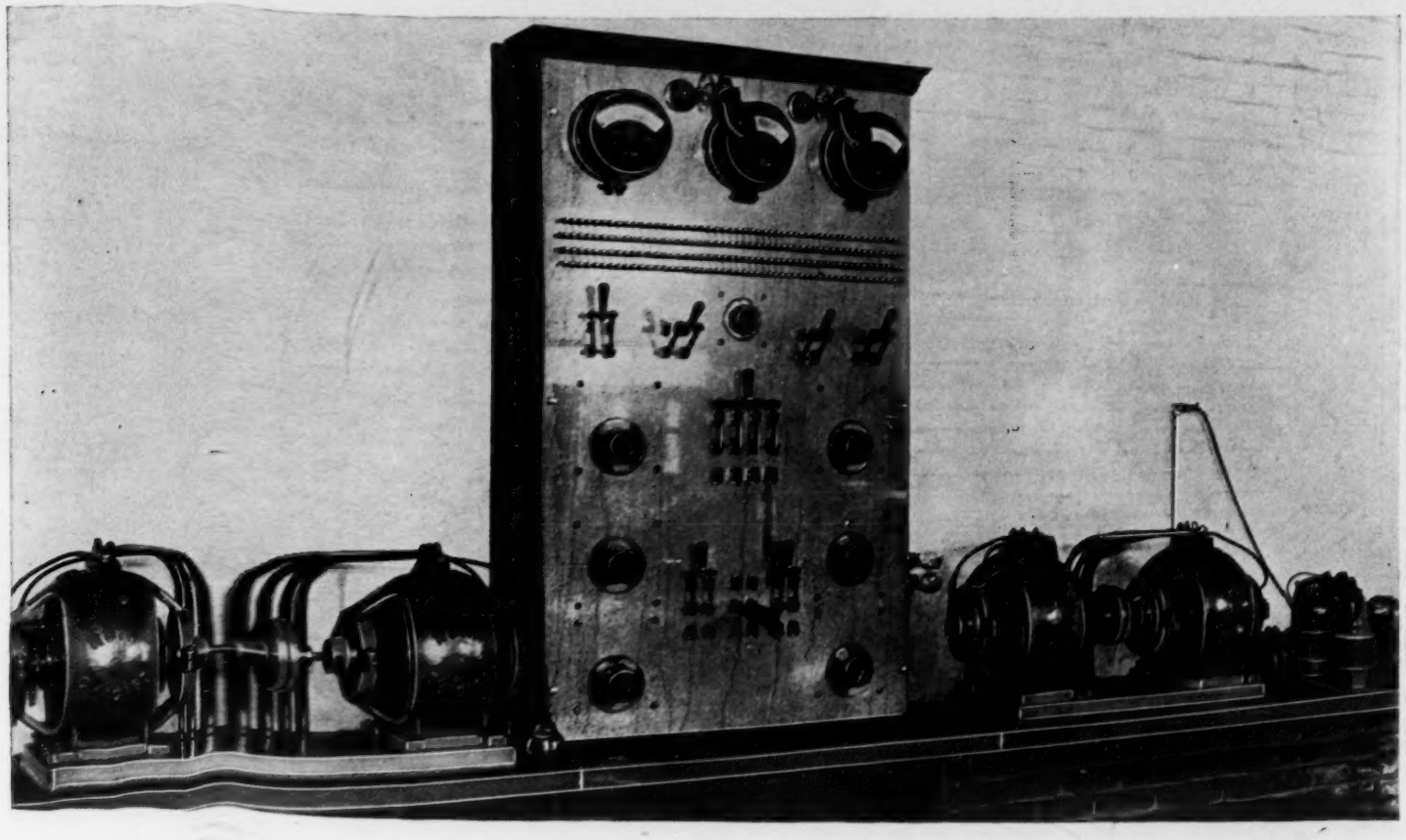


FIG. 4.—POWER SWITCHBOARD, MOTOR DYNAMOS AND MOTOR GENERATORS, ROCHESTER TELEPHONE COMPANY.

assume that the magnetic circuits are so far removed from saturation that the characteristic on open circuits is a straight line; and, furthermore, assume that the apparent internal resistance of the alternator reduces itself to the inductance, ωl, and remains constant whatever the current and phase relation.

As is well known, to represent the induced e. m. f. it is merely nec-

essary to draw from A, the vector, $A\,B$ equals $\omega\,H$, perpendicular to the direction of the current, and to join OB. The direction, OB, of the induced e. m. f. is independent of the output and phase relation. The vectors, OA and OA', on the other hand, vary the one, OA in direction only, and the other, OA', in length and direction with these two quantities, but always in such a manner that the direction of the resultant, OB, is unchanged.

Assuming, as has been done above, that the e. m. f.'s are proportional to the exciting current and the latter to the voltage of the terminals at the exciter, then the e. m. f. induced in the alternator will be proportional to the field flux in the exciter. If then, we can design an exciter excited not only by an ordinary field, but by two rotary fields (naturally supplied by the alternator itself), giving fluxes proportional to the two vectors, AO and AO', and maintaining between them and with respect to the fixed vector, OB, the same angles as these vectors, we shall obtain a perfect compoundage of the alternator. If the exciter has the same number of poles as the alternator—bipolar, for example—it is evidently merely necessary to supply two polyphase windings of proper dimensions,* one in shunt with the alternator terminals and the other in series with the working circuit, and make them act on a common winding on the two rings carrying the polyphase winding. It remains to be seen if the difference of phase between the two fields and with respect to the vector, OB, can also be obtained.

Let us suppose that the exciter is mounted on the same shaft with the alternator and that the connections of the field circuits are so arranged that the field will turn in an opposite direction to the machine. These fields will become fixed in space when they turn in a direction opposite to the alternator field, and with the same speed as the latter.

The flux due to the rotary field, the winding of which is in shunt with the terminals of the alternator, will be shifted in phase by a quarter of a period with respect to the e. m. f. at the binding post, represented by $O\psi$ in Fig. 57; that due to the series winding will, on the contrary, coincide in phase with the current; and if the output of current in the two circuits corresponds, the flux corresponding to the current may be represented by the vector $O\psi'$. The vector, $O\psi$ and $O\psi'$ being proportional to OA and OA', and perpendicular respectively to the latter, their resultant will be proportional to OB and perpendicular to that direction. The resulting field in the exciter will then not only be proportional to the voltage to be obtained in the alternator, and consequently, according to our hypothesis, to the exciting current to be produced in the alternator, but also will have a fixed direction in space. If these fields act on an ordinary direct-current armature, the line of commutation and consequently the position of the brushes will be fixed in space, if care be taken to annul the armature reaction, as has been proposed by M. Leblanc, by the addition of a Ryan compensating winding.

Fig. 60 represents the scheme of circuits of an exciter of this type designed by the Societe la Transmission de la Force, and shown in the Grammont exhibit. This type may be described as follows:

On the alternator shaft, OO, are two rings, A and B. Around the ring A is a polyphase winding, S_1S_1, corresponding in character to that of the alternator. These circuits are connected in series with the corresponding circuits of the alternator by means of brushes and collector rings.

On the ring, B, is mounted another polyphase winding also corresponding in disposition to those on the armature of the alternator and connected in shunt with the working circuit. A third and direct-current winding, E, covers the rings A and B, and is connected to a commutator, CC. From two brushes on this commutator the exciting current of the alternator is taken. The rings, A and B, are surrounded by iron cylinders, DD and EE, which furnish a path for the magnetic flux generated. The sections of these rings, DD and EE, are fixed in such a manner that the magnetic circuits along which the flux due to the ring, A, passes, are always far from saturation; while, on the contrary, the magnetic circuits along which the flux generated by the ring, B, passes, are highly saturated when the exciter is in normal operation.

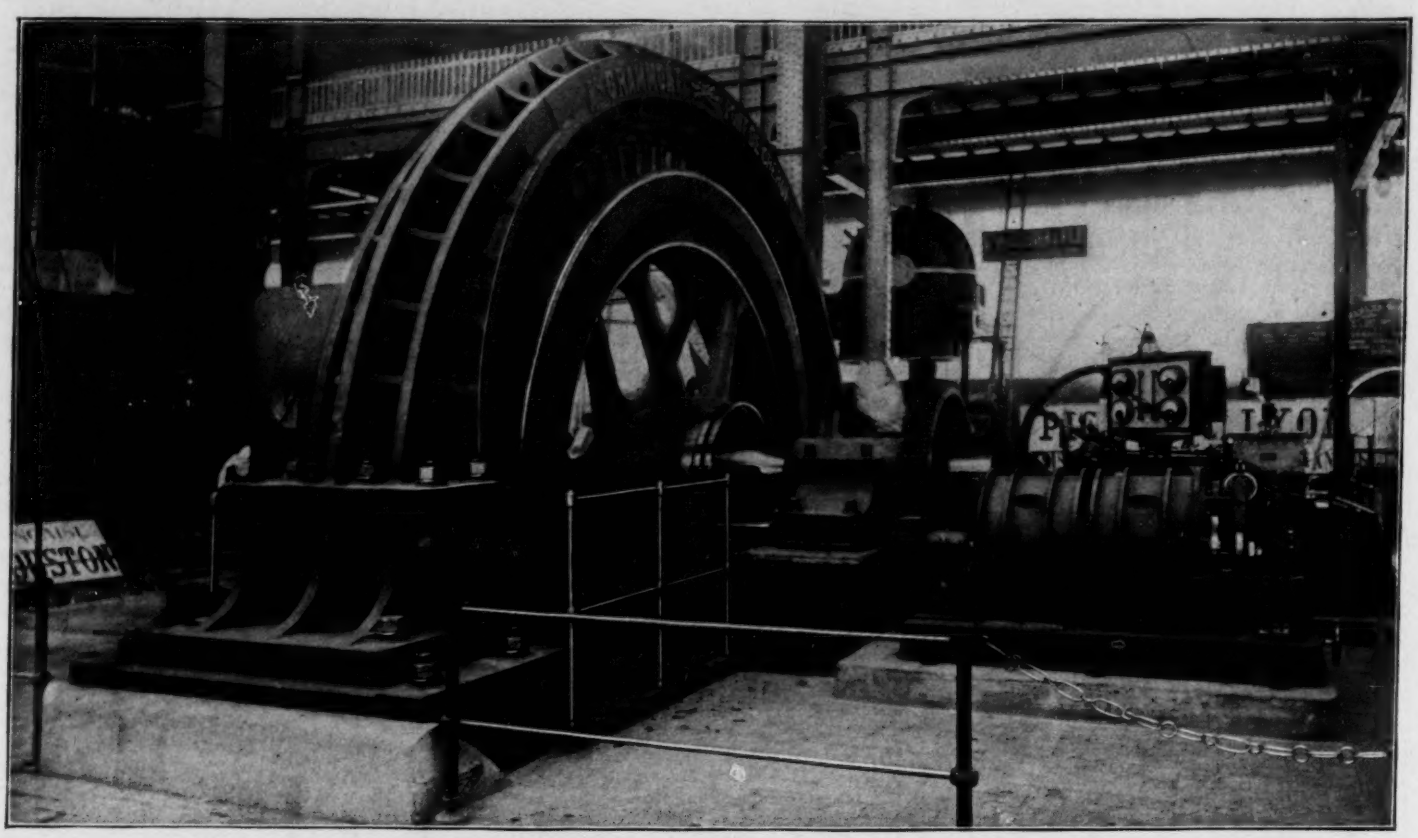


FIG. 53.—GRAMMONT ALTERNATOR.

Finally, another circuit surrounds the rings, DB and EF. It has as many turns as the armature circuit, and is traversed by the current from the armature brushes. The current has such a direction in this winding that the magnetizing forces developed by it will always be equal to and contrary in sign to that developed by the circuit, EE. Under these conditions the currents which traverse the two direct-current circuits will give rise to no flux in the exciter, since each neutralizes the effect of the other.

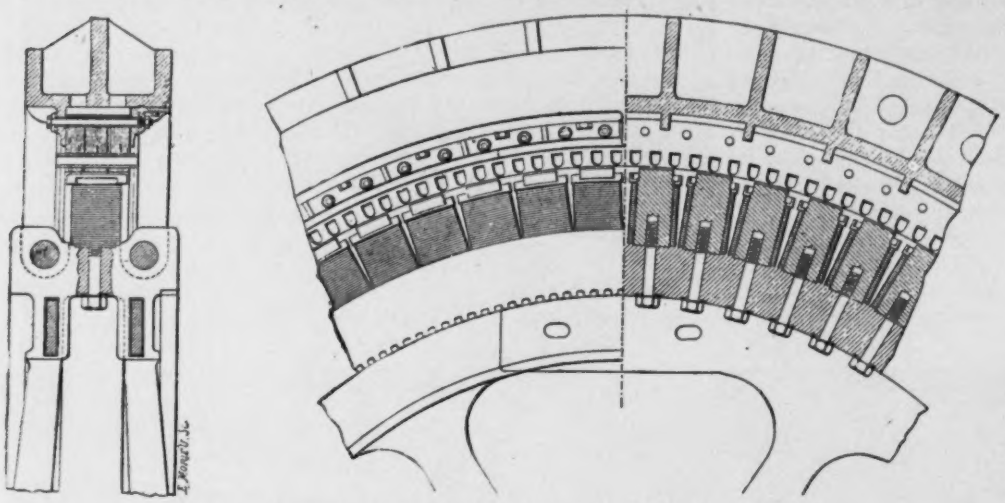
The operation will be relatively the same if the alternator and exciter have not the same number of poles, but have speeds in inverse ratio to the number of poles. In this case the exciter will be geared to the alternator.

The preceding disposition has the disadvantage, which at times may be serious, by requiring that the number of poles of the exciter

* It suffices to take $O\psi = k\,U$ and $O\psi' = k\,I\sqrt{r^2 + \left(\frac{2\pi}{T}\,l\right)^2}$. See article by M. Leblance in *L'Eclairage Electrique*, t. xvii., p. 429.

and alternator to be in inverse ratio to the angular velocities. This objection can be obviated by employing a very ingenious disposition which permits of the collection with fixed brushes of a direct current from the commutator of an armature subject to the action of a field turning with respect to the armature, the field being composed, as above, of two rotary fields proportional to the terminal alternator voltage and to the e. m. f. of self-induction of the alternator. This disposition is based upon the two following considerations:

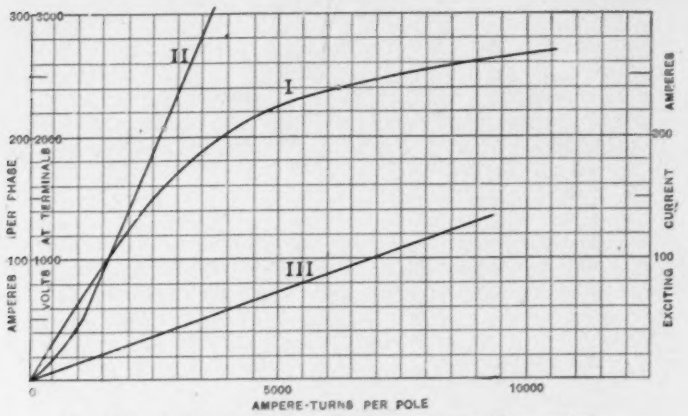
First, consider a direct-current, bipolar Gramme ring dynamo, for



FIGS. 54 AND 55.—GRAMMONT ALTERNATOR.

example, the armature of which has an angular velocity, n, in the direction, qq' (Fig. 59); and suppose that we invert all of the connections of the coils, with respect to any diameter, xy (in the sketch the usual connections are indicated in dotted lines and the inverted connections in full lines). To collect a direct current from this machine the segments should move under the brushes in the same direction as with an ordinary winding. To this end it evidently suffices to turn the brushes with an angular velocity, n, with respect to the armature, and in the same direction. As the armature has a speed, n, the brushes will have an absolute speed of $2n$; we can thus say more simply that the line of commutation, fixed in the case where the connections are as usual, is displaced with an angular velocity equal to $2n$.

If now we suppose that the field and armature together turn with the speed, $2n$, in opposite directions, the brushes will become fixed and the field will turn in space with the speed, $2n$, and with the speed, n, with respect to the armature, the latter also having the



I.—No-load Characteristic. II.—Short-circuit Characteristic.
III.—Excitation line.

FIG. 56.—CHARACTERISTICS OF GRAMMONT ALTERNATOR.

speed, n. For a machine with $2p$ poles one would evidently obtain the same results by adopting, p, axes of commutation.

Second, considering in the next place a multipolar direct-current dynamo with parallel winding, let $2p$ be the number of poles and $2pm$ the number of armature segments. To obtain a direct current from this machine when the armature turns with an angular speed, n, it is necessary, of course, either to cross-connect the brushes having the same potential or to employ two pairs of brushes and cross-connect the armature segments. We may also obtain a direct current if we reduce the $2pm$ armature segments to $2m$ and unite the p points having the same potential, to a single segment and cause two diametrical opposite brushes to revolve with a speed p times greater than that of the armature or pm; for in this case the number of segments which will pass under a brush during a given time will evidently remain the same.

If, as above, we give to the whole a speed of pm in a direction opposite to the rotation of the armature and of the brushes, the latter will become fixed while the armature and the field will turn in the same sense with speeds respectively equal to $(p-1)n$ and pn.

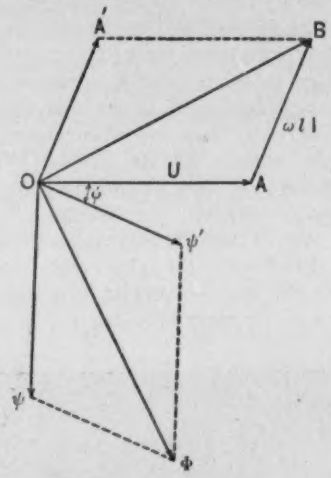


FIG. 57.—DIAGRAM OF VOLTAGE, HUTIN AND LEBLANC EXCITER.

Suppose now that instead of reducing the number of segments p times we reduce it only k times, k being a divisor of p, we can then easily conceive that it will suffice to turn the brushes with a speed equal to $\frac{p}{k}n$ to obtain a direct current. In increasing the number of segments by a multiple of p—that is to say, by making k the multiple of p—we can thereby decrease the velocity, but always in the inverse ratio of k, and the speed of the brushes will then become equal to $\frac{p}{k}n$.

We will now see how we can utilize these two properties, or any one of them, to produce a direct-current exciter with fixed brushes, and a rotary field therefor by the composition of two fields, the windings of which are, one in shunt with the terminals of the alternator, and the others in series with the circuits of the alternator. Let a be the frequency of the current produced by the dynamo and $2p$ the number of poles of each of the two fields and of the armature of

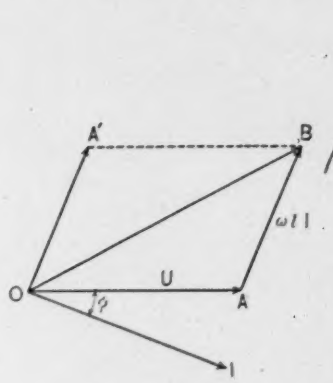


FIG. 58.—DIAGRAM OF VOLTAGE, HUTIN AND LEBLANC EXCITER.

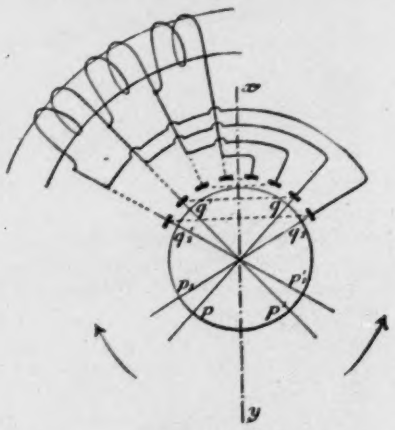
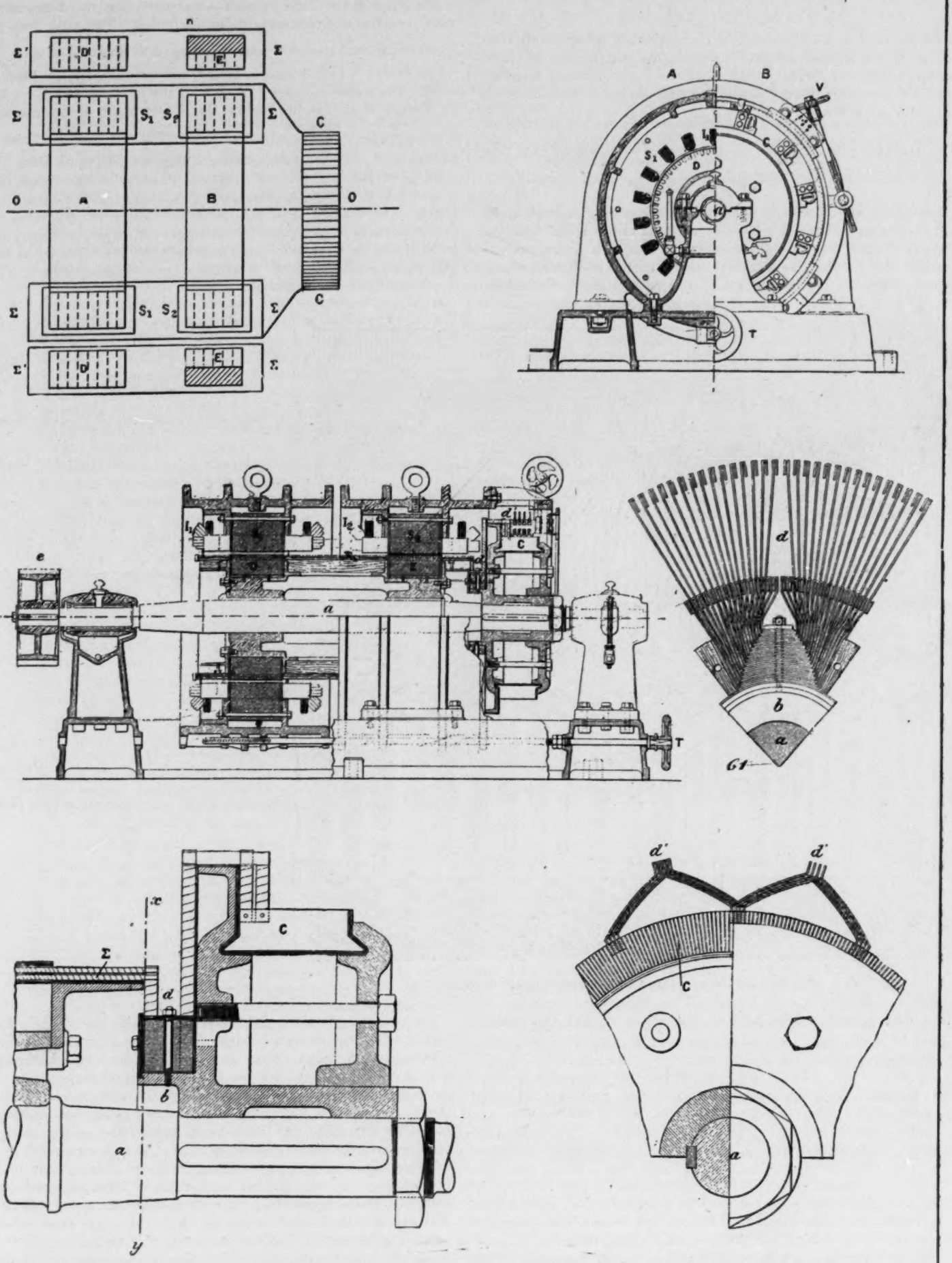


FIG. 59.—HUTIN AND LEBLANC EXCITER.

the exciter. The angular speed, n, of the revolving field, and consequently of the resultant field, will be given by relation, $np = a$, or $n = \frac{a}{p}$. The angular speed of the armature being n', the speed relative to the field of the exciter, admitting that the armature turns in the same sense as the field, is $\frac{a}{p} = n'$. This will also be the relative speed of the brushes with respect to the armature if there are $2p$ pairs of brushes; if this becomes $2k$ the speed of the brushes will be



FIGS. 60 TO 65.—HUTIN AND LEBLANC EXCITER.

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modified, as we have seen, in the ratio of $\frac{p}{k}$, and will become

$$\frac{p}{k}\left(\frac{a}{p} - n'\right)$$

Inverting now, as above shown, the connections of the armature with respect to the axes of symmetry, the brushes maintaining the same relative speed with respect to the armature, but in contrary direction from the preceding, it results that the absolute speed of the brushes will have for a value $\frac{p}{k}\left(\frac{a}{p} - n'\right) - n'$

The condition with respect to the fixed position of the brushes is thus

$$\frac{p}{k}\left(\frac{a}{p} - n'\right) = n', \text{ or } p + k = \frac{a}{n'},$$

a relation in which a only is known. (We will refer later to the values of p and of k, which have been chosen in the actual design of the exciter). By causing the armature to revolve in an opposite direction from the field, we can make the brushes fixed without changing the connections of the armature. The relative speed of the armature with respect to the field is then $\frac{a}{n} + n'$, and the relative speed of the brushes with respect to the armature for $2k$ lines of symmetry is

$$\frac{p}{k}\left(\frac{a}{p} + n'\right)$$

The brushes turning in the same sense as the field, their absolute speed is

$$\frac{p}{k}\left(\frac{a}{p} + n'\right) - n'),$$

which gives for the condition involving fixed brushes,

$$k - p = \frac{a}{n'}.$$

These solutions require that a shall be a multiple of n', and leads to the employment of a number of brushes too large for a convenient speed, n', of the exciter. It thus has no practical value.

In an exciter having a rotary field and an armature rotating in the same sense as the field, we have in fact a true rotary converter and the driving gears impose a definite slip. The action of the fields thus tends to bring the armature to the speed $\frac{a}{p}$ in such a manner that the pinion mounted on the shaft of the armature tends to drag the shaft of the alternator. The energy borrowed by the fields of the exciter from the armature of the alternator is thus partially restored to the latter in the form of mechanical work, the part taken being transformed into direct current for excitation. The ratio thus restored to the total electrical work furnished will evidently be n' to $\frac{a}{p}$.

The exciter is represented in section and partial views by Figs. 61 to 65. The number of poles of each of the fields, S_1 and S_2 is six, the number of pairs of brushes 12; the angular speed of the armature, $n' = \frac{a}{p+k} = \frac{50 \times 60}{3 \times 6}$, is 333 r. p. m. The two stators, A and B, have each an ordinary three-phase winding disposed in 18 slots. The coils, I, of the field, S, are composed of wire of one-eighth inch diameter, there being 3 coils and 92 turns in each circuit mounted in series. The winding is of the star type. The windings, I_2, of the field, S_2, are, as in the case of the alternator armature, composed of a cable of 69.4 mm² section, with 7 turns per slot; the sections of each phase are in series with the armature circuit of the alternator. The armature, E, of the exciter, has a 6-pole drum winding.

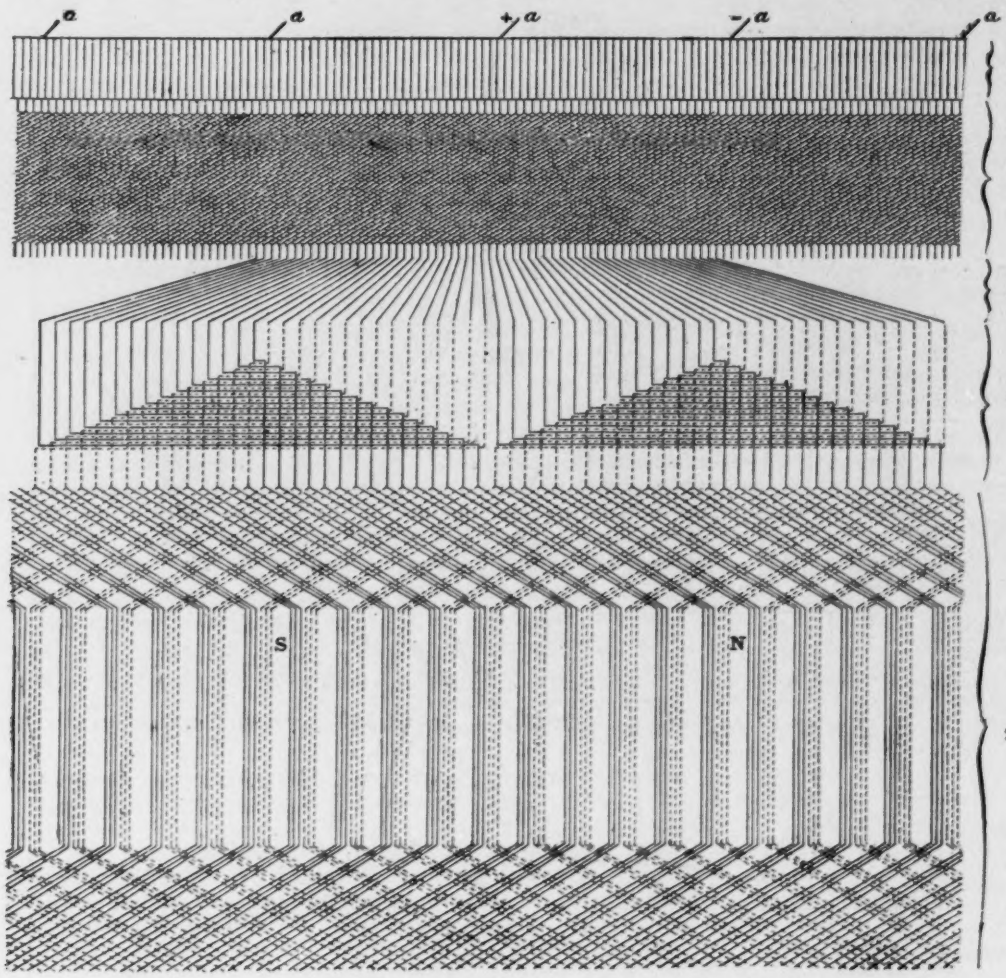


FIG. 66.—HUTIN AND LEBLANC EXCITER, SCHEME OF WINDINGS.

The inversion of the connections is made with the aid of connectors, d (Figs. 64 and 65), formed of two bands of narrow copper of different length, united on the two opposite sides with a wider band, and at the extremities with the same diagonal of these bands. All the wide bands corresponding to the interval between two poles are insulated from each other, and secured on a cylindrical support by means of bolts (Fig. 63). The connection of the sections with the commutator segments is made by means of bars connected to the long end-connectors, d, and uniting the latter to a system of connectors, d' (Fig. 65), identical with those of multiple armatures in parallel. The commutator, C, has 360 bars and a diameter of 20 ins. The brushes, to the number of 36 (3 per set), are mounted on a support which can be displaced by means of a tangent screw, V.

Fig. 66 indicates the scheme of connections of the exciter armature to the commutator segments. In order to over-compound the field, S_1 may be adjusted by means of a screw, T, the adjustment consisting in causing the field to be displaced in such a manner as to cause it to surround more or less of the armature, thereby modifying its action.

Extension of the 40,000-Volt Lines of the Telluride Power Transmission Company in Utah.

BY J. R. CRAVATH.

TO the Telluride Power Transmission Company the engineering world owes a debt of gratitude. The management of this company was the pioneer in commercial transmission at high voltages in the mountain districts of the United States, going ahead where others feared to tread, and demonstrating facts which were of the greatest value. Then followed the famous Scott experiments, which were made on this company's property at Telluride, Colo., and where line voltages reached 135,000. This company has for three years been operating a line at 40,000 volts, transmitting from the Provo Cañon, north of Provo, Utah, to Mercur, Utah, a distance of 35 miles. This was principally for supplying power to mines, and is the highest voltage line in regular commercial use at present writing. In addition to this, 70 miles more of high-tension line have been completed, so that the transmission line now completely encircles Utah Lake, supplying power and light to various points on the circuit as desired, and returning to the Provo Cañon plant from whence it starts. In ordinary operation this practically gives two circuits to any point on the circuit, and is much better than duplicate lines on the same pole line, because some kinds of interruptions would affect both circuits equally if on the same pole line. The circuit is sectioned up so that in case of a breakdown on one section that section can be cut out and the service supplied by the lines on both sides of the interruption. Repairs are regularly carried on in this way without interruption of service. No repairs are made on the live line, as it is impossible. The transformers are operated with Y-connection, and the neutral point is grounded for the protection of the transformers against lightning. In the three years since the plant started the only 40,000-volt transformer lost was one which accidentally got wet. The first transformers for the 40,000-volt line were built under the supervision of this company's men at the Wagner factory in St. Louis. They are oil insulated. The line insulators are triple petticoat glass, made by the Hemingway Glass Company, Muncie, Ind., and designated as Provo No. 1. There is no trouble from puncturing these insulators from the voltage alone, but they are shot at and broken occasionally. The Telluride Company uses glass for insulators on all its work, and believes it to be superior to porcelain. The glass insulators are not put to any electrical test before being put up, because defects are apparent to the eye with glass, as they would not be with porcelain. These insulators are about 7 in. in diameter. They are not center-bearing, but the wires are tied into a groove on the side.

It is of value to note that this line has not been subject to interruption by the throwing of wires, sticks and weeds across the lines, as have some of the other lines in the State. This is mainly because of the great distance apart of the line wires. They are placed to form the corners of an equilateral triangle, and are 64 in. apart. The top wire is on a pin on top of the pole, and the other two are on a cross arm 7 ft. long. This creates conditions so that it takes a great deal more skill and strength than the meddlers seem to care to exert to throw over the lines anything long enough to make a short circuit. It has been found not only impossible to use the telephone over circuits run on this same pole line, but the presence of the telephone circuits proved a source of danger to the poles. The telephone wires were run on short cross-arms, and discharges across from the pole to the telephone wire frequently burned holes in the pole. Running with a grounded neutral doubtless has much to do with these effects. The locust pins on the transmission line were all boiled in paraffin, and the cross-arms were treated by being kiln-dried and then dipped in a bituminous compound at 100 degs. F. The bitumen penetrates ⅜ in. into the wood. It is found that metal bolts and nails are good things to avoid in poles, because if there is any leakage down the pole it is concentrated by the metal so as to char the wood around the bolts. This company's new work will have no bolts, but will have holes cut through the pole tops to fit the cross-arms, and the cross-arms will be driven through and held in place by locust pins. On level ground 40-ft. poles are used, and in mountainous country 35 ft. Lines for the telephone service, which is necessary in operating a system of this kind, are leased from the Rocky Mountain Bell Telephone Company.

The high-tension line from the Provo Cañon power house to Mercur, which was the one first built, has 44 poles to the mile, and consists of three No. 5 copper wires. From Mercur to Eureka the line is of aluminum stranded cable, equivalent to No. 5 copper, and made up of seven strands .088 in. diameter. From Eureka to Provo the line is stranded aluminum cable, seven strands of .099 in. diameter. Poles on the aluminum line are set only from 26 to 33 to the mile on account of the lightness of the aluminum. This, of course, makes quite a difference in the cost of the line as compared with copper in addition to the saving in the cost of the wire. Solid aluminum wires were first put up, but had to be replaced with stranded cable, because of breakage.

At most of the sub-stations, the reduction is from 40,000 to 5000 volts, for local distribution. The greater part of the company's load is in the shape of induction motors. There are a few towns lighted but that load is small compared to the total. All charges are by flat rates.

The capacity of the 105 miles of line is very great. With no load on but the transformers, the apparent kilowatts at the power house are 750, and the actual watts nearly nothing. As the load comes on the wattmeter rises and the ammeter falls until at about two-thirds of the station's full load, the power factor is 95 per cent. No need for synchronous motors to improve the power factor on that line! It is, however, a novel sensation to the majority of engineers to see the ammeter fall as the load rises. The 5000-volt distribution in the town of Provo is over No. 8 B. W. G. iron wires. The pole lines are run down the center of the wide streets, and transformers and incandescent street lights are hung directly from the cross-arms. The primary wires have a cross-arm on top of the pole, while below it are the secondary mains. The Eastern reader may smile at this arrangement, but it is not exaggerating to say that the pole lines are neater in appearance and safer in fact than in nine out of ten Eastern towns of the same size. The East has much to learn from the West in the matter of neat pole-line construction.

Although the Telluride Power Transmission Company's Utah system is already extensive, important permanent additions are to be made to it. In place of the present plant in Provo Cañon, a more permanent one will be built at the mouth of the cañon to develop 8000 hp at 380-ft. head. There is now going in at Logan, Utah, a 3000-hp plant, which will connect in parallel with the present 105-mile circle by a 90-mile 40,000-volt aluminum line running down past Ogden and Salt Lake City, at which latter place it is not unlikely that some power will be delivered. A. S. Woodhouse is superintendent of the Utah department, with headquarters at Provo. The main office of the company is at Telluride, Colo. A 15,000-hp water-power is also being developed 70 miles from Butte, Mont., by parties interested in the Telluride Power Transmission Company.

Telephone Meeting of the New York Electrical Society.

The 212th meeting of the New York Electrical Society was held on Feb. 14. Mr. Kempster B. Miller, chief engineer of the Kellogg Switchboard & Supply Company, of Chicago, lectured on "Modern Telephone Engineering." Mr. Miller discussed very fully the equipment of the telephone exchange, its functions, and many important engineering problems connected with it. Mr. Miller also exhibited a number of curves and views, etc., which were of the greatest interest, and in many ways threw important light on improved telephone practice, about which there has been a lack of information in recent years. The lecture was greatly enjoyed by a full audience.

The president announced the election of Mr. C. E. Knox as vice-president, to take the place of Mr. W. C. Burton, who has resigned in consequence of his continued stay in England.

The following members were elected: A. L. Orton, New York Telephone Company, 32 Gold Street, city; Munson D. Atwater, 22 Thames Street, city; Walter L. Thompson, 115 West Forty-ninth Street, city; Frank B. Rae, 45 Broadway, city; William Kent, *Engineering News*, 220 Broadway, city; A. B. Eads, Western Electric Company, Bethune Street, city; James R. Strong, 35 South William Street, city; E. B. Lever, 174 Washington Avenue, Newark, N. J.; William B. Osgood Field, president Holophane Company, 15 East Thirty-second Street, city; E. L. Elliott, 15 East Thirty-second Street, city; J. M. Wakeman, ELECTRICAL WORLD AND ENGINEER, 120 Liberty Street, city; David Killock, 214 West 105th Street, city.

The lecture, like that of Mr. Steinmetz on alternating-current work, is to be put into shape for publication by the Society, and can therefore be referred to but briefly here. Mr. Miller said he believed it to be a well-established fact that the best telephone service can be given where all the lines of the subscribers in a city run to a single

exchange, and are there handled by a single multiple switchboard. By this means all calls for connections by any subscriber may be handled by a single operator. Where the number of subscribers, however, is too great to be connected to a single switchboard, or where the distribution is such as to naturally group them about well-defined and remote centers, a greater number than one exchange must be installed and lines provided between them for connecting the subscribers in the different exchanges. Such lines are called trunking lines in distinction to subscribers' lines which connect the subscribers with the central office. In most cases where trunking is necessary, most calls have to be trunked. He said the percentage of trunked calls to total calls for Greater New York is in the neighborhood of 80. A connection made over a trunk line necessarily occupies more time and thereby renders the service a little slower; in fact, the aggregate time required for connection over a trunk line is practically twice as great as where accomplished by a single operator in a multiple board. The fact that two operators necessarily handle a trunk connection necessarily increases the liability to error in making the connection and therefore produces less satisfactory service. The trunking apparatus and circuits in order not only to transmit speech but to convey the requisite signals between the operators are necessarily more complex than subscribers' line circuits, and thereby a greater liability to trouble exists than where no trunks are required.

Mr. Miller then went on to consider the question from the standpoint of operating expenses, and came again to the conclusion that it was altogether best to have one big exchange, even of 100,000 subscribers. As to length of subscribers' line with one central, he said that Mr. F. J. Dommerque had shown that in Chicago it would be 20,000 ft. He noted the fact that hitherto the Bell systems had been limited to exchanges of a switchboard capacity not to exceed 6000 lines. But there was a tendency to larger exchanges among both the Bell companies and the independents. The Cuyahoga Telephone Company, of Cleveland, is now equipped with a multiple Kellogg board having a capacity of 9600 lines installed, and with an ultimate capacity of about 20,000. The board at Paris, France, equipped by the Western Electric Company, has a present capacity of something like 9300 lines, and the Kinloch Telephone Company, of St. Louis, Mo., has a present equipment of 8800 lines. Mr. Miller understood that a number of exchanges to be operated by the Bell Company are now being planned or built, having a capacity of 9000 lines and upwards.

In this connection the lecturer discussed the practical limitations in building boards, and mentioned that in the Paris Western Electric board the jacks were inserted on three-eighths of an inch centers, both horizontally and vertically. His own company had recently worked out a system in which the jacks could be built on quarter-inch centers, giving one operator control of at least 25,000 lines. Another way out was the "divided" multiple board as seen in the Kellogg exchange at St. Louis. With an exchange in four divisions, and jacks on quarter-inch centers, over 90,000 lines could be brought together without giving the operators as great a reach as they have at present on some multiple boards; while there would be no trunking.

Mr. Miller stated that with prompt service, connections could be made in about six seconds. The average time of a conversation was less than two minutes. He showed by elaborate diagrams how the connections were made, employing Bell circuits for this purpose. He also showed by curves how the load of an exchange ran through the day. It was curiously brought out that with the cheaper "independent" service shown, business began earlier, less time was consumed for lunch, and the load continued later into the afternoon. After showing views of large Bell and Kellogg exchanges, Mr. Miller illustrated most interestingly the details of modern telephone apparatus, including plugs, jacks, relays, lamps, cords, cables. etc. He closed by saying that in the future of telephony the large cities would be the main offices, the smaller towns and villages the branch exchanges, and the long-distance lines the trunks of the systems.

Automobile Legislation.

A bill was prepared by the Automobile Club of America and offered in the United States Senate by Senator Platt, of New York, and it has already undergone several stages of advancement. So far there has been no opposition to the measure.

The Dynamo in Recent Telephone Practice.

BY D. M. BLISS.

AN inspection of a modern telephone exchange reveals many interesting departures from the standard practice of a few years ago. This is especially true of the latest development in the telephone field, the central energy or common battery system. In this method of operating an exchange the subscribers' local battery and calling generator are dispensed with and the energy necessary for the signaling and talking currents are supplied by a suitable plant at the central office and distributed throughout the system. In an exchange, therefore, of any reasonable size the amount of power to be continuously taken is much greater than is usually supposed to be necessary in telephone work; hence it is a matter of considerable importance when remodeling or equipping new systems to give the most careful consideration to the generating devices and to arrange it in accordance with modern engineering practice.

Most of the generating apparatus required for modern telephone work is distinctly special in character, and cannot be purchased in the open market. A description, therefore, of apparatus which may now be considered standard for supplying exchange systems, its location and the most desirable arrangement of circuits will, no doubt, prove of interest to those engaged in the telephone field.

Considering, first, the source of direct current for transmitter service, the storage battery has been and is still very largely employed. Its low internal resistance, high e. m. f., compactness and great current capacity render it particularly well adapted for common battery service.

Fig. 2 shows a good arrangement of circuits using storage battery in duplicate, with means for charging furnished by a dynamo of the ordinary description. It will be noticed that one set of batteries is continuously on the system while the other set is being charged; all necessary connections between the lines, batteries and the charging mains being effected by means of double-throw, double-pole switches so arranged that there is no danger of interrupting the service.

It is of vital importance that storage batteries of whatever make or description have systematic and intelligent care. If properly installed and attended to they give excellent service at a moderate expense, but if from any cause deterioration of cells once sets in. effective service will be impossible, and the life of the batteries will be greatly shortened, to the discredit of the storage battery rather than the management, which in nine cases out of ten is responsible for such a result.

The proper care of storage cells, the location and cure of their troubles can only be learned by practical experience and only men who have had this training should be put in charge of this important part of a modern exchange equipment.

The charging machine is usually of the shunt-wound type, wound for a maximum pressure of about 35 volts. If for any reason a compound-wound machine is used, means should be provided for shunting the series winding while the cells are being charged, the charging pressure being regulated in the usual manner by a shunt field rheostat as shown.

Both gas and gasoline engines have been used with success for operating charging dynamos where the local conditions allow of their use. But as exchanges are often built in residential districts, it may be found necessary in some cases to drive by electric motor and thus avoid a frequent source of complaint where gas engines are used.

When only one set of storage batteries is used or where it is intended to operate a system directly from the dynamo the selection of a suitable generator for this service is a matter of great importance and telephone engineers should not be misled by the idea that the ordinary bi-polar and multi-polar design, however successful it may be for lighting and power purposes, will be suitable for telephone work. While the current they generate is direct, it is not of a sufficiently steady character for transmitter service.

Modern dynamos are built with slotted core armatures and a high-field density. This, with the high self-induction and comparatively few number of coils in the armature, combine to produce a current which is so noisy in the telephone circuit as to make intelligible conversation impossible; no better proof of this can be furnished than listening on a telephone circuit subject to leakage and excessive induction frequently found on telephone systems. In these cases the disagreeable hum and buzzing of railway and lighting circuits is a serious hindrance to conversation, and if this is the case

with the comparatively feeble currents induced in such a circuit it can be readily seen that a machine of this type feeding a telephone system directly is out of the question, and no arrangement of choke coils and condensers will remedy or remove this defect.

A dynamo for direct service or for use in multiple with storage batteries must deliver a current perfectly free from pulsation, and the commutator and collecting device must be of such a character as to eliminate any possibility of imperfect contact at this part of the machine. These desirable results can only be reached by having a machine designed especially for telephone service. Such a machine is shown in Fig. 3, coupled to a driving motor, both mounted on an iron sub-base.

It is of the multipolar type, the armature is smooth or surface wound with a great number of coils of only one turn each, and connected to a commutator having an equally large number of segments. The induction in the field is comparatively low, and the pole shoes are so shaped that any given coil enters the field in a very gradual manner regardless of the speed at which the armature is running. The brushes are of finely woven copper wire so that perfect contact is obtained at all times with the commutator, and the very slight pulsations in the current are so rapid in character as to be inaudible.

With this machine a very slight whistling is noticed at times, which is due to the action of the brushes on the commutator, and which is entirely corrected by impedance or choke coils.

This dynamo has become practically a standard with several leading telephone companies and solves quite a serious problem in the power equipment of most common battery systems. The largest size known to the writer is of 10-kw capacity of the above design, which is in use in several of the exchanges of one of the leading sub-companies. A smaller size very much in demand is rated at ¾ kw, delivering a current of 20 amperes at 30 to 35 volts.

In some cases, when used in connection with storage batteries, these machines are compounded, provision being made for short-circuiting the series coil when batteries are being charged; at other times the dynamo feeds the circuits directly. A machine of this sort renders unnecessary the use of a spare or duplicate set of storage cells, or where power can be obtained at all times the cells may be dispensed with entirely.

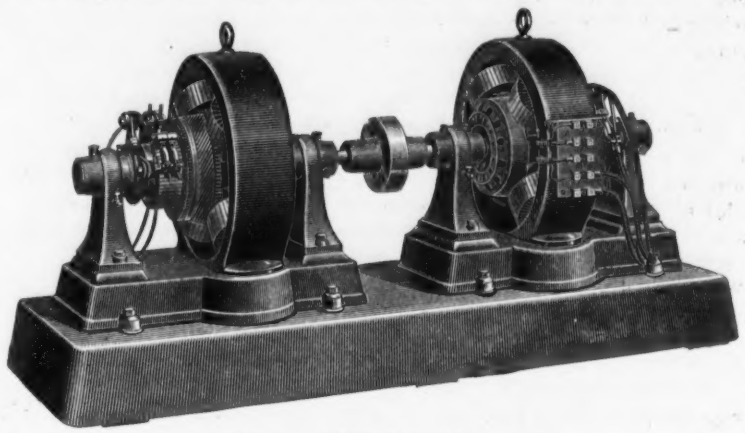
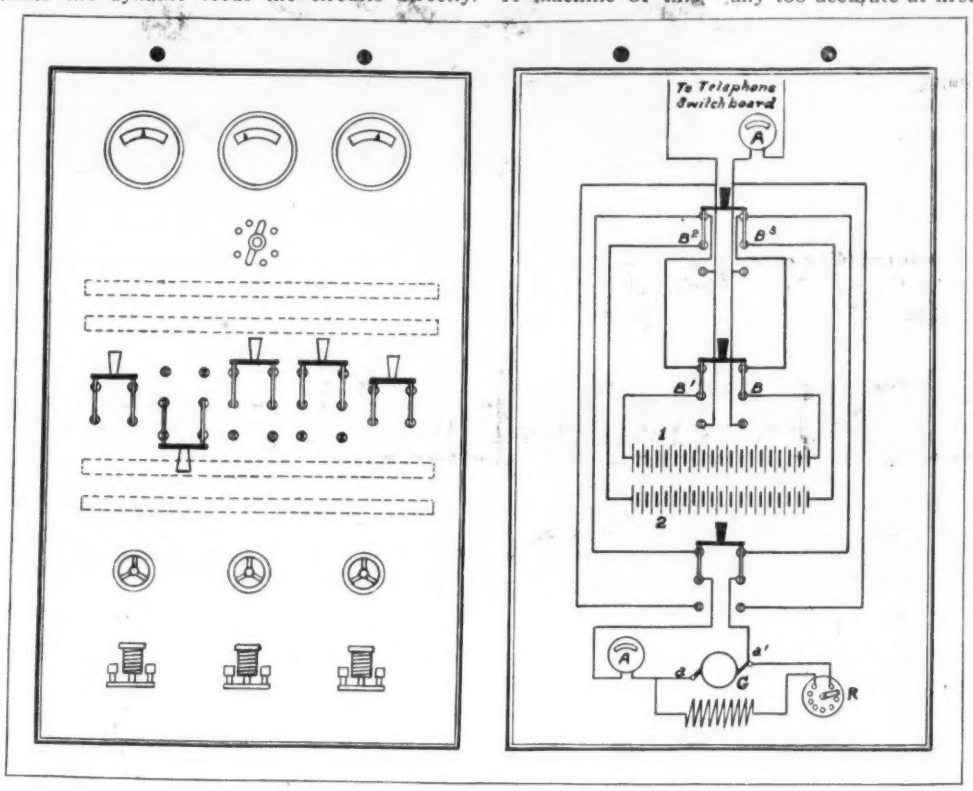


FIG. 3.—MOTOR DYNAMO.



FIGS. 1 AND 2.—DIAGRAMS OF SWITCHBOARD AND CIRCUITS.

Referring again to Fig. 2, the storage batteries in two equal groups, Nos. 1 and 2, are connected to independent double-throw switches. The generator, *G*, is a plain, shunt-wound machine, with a field regulating rheostat, *R;* the latter should have a large number of contacts so as to give the closest regulation and should have sufficient resistance to give a suitable variation of pressure at the dynamo terminals.

The dynamo leads are connected to a main double-throw switch, as shown. This switch in one position will connect the dynamo to the battery charging mains, and when thrown to the lower position will be connected directly to the main telephone bus-bars so that if the machine is of the noiseless type it may be used in case of accident to the battery system to support the telephone circuits directly. As arranged in this diagram the battery switches when thrown to their upper contacts will connect the battery to the charging dynamo, and when thrown down will be connected to the telephone mains.

An ammeter should invariably be used on the dynamo circuit, and in the telephone mains. It is also convenient, but not absolutely necessary, to have one in each of the battery circuits.

A voltmeter with a suitable switch should be arranged so that the pressure can be taken from *A*, A^1, *B*, B^1, B^2, B^3. It is essential for good service that the ammeters and voltmeters should be standard and of first-class construction. A low-priced instrument usually proves a very costly investment in the long run, as the readings, not any too accurate at first, soon show such a large error that they are practically worthless and liable to lead to serious results, especially when used with storage cells.

Referring to Fig. 1, in which the details of the switchboard are shown, this arrangement has proved very satisfactory in practice, and as here illustrated, corresponds to the system shown in Fig. 2; the voltmeter switch being placed in the center with the dynamo and main circuit ammeters on each side. The double-throw dynamo switch is in the center with the double-throw battery switches on either side.

One of the two smaller switches shown at the outside of the board is used for the motor switch when the generator is motor-driven. The other switch at the opposite side of the board is for connecting in the ringing or pulsating current generator.

Immediately below the main dynamo switch at the center of the board is the field regulating rheostat for the charging dynamo; while the small rheostats at either side control the motor and ringing generator, respectively.

Circuit breakers at the lower part of the board are shown, and it will be found in practice that automatic circuit breakers of standard make are much to be preferred to the uncertain and unsightly fuse.

The switchboard should be made of the best quality of slate, free from veins, if possible, and filled by driving paraffine into the pores of the stone by means of a gas torch and blow-pipe. This precaution is quite necessary where good insulation is required, as in a switchboard of this character 500 volts is quite frequently used to operate the motors and motor generators.

A very frequent error in erecting a switchboard is placing the board too close to the wall or partition. It should stand out as far as possible with plenty of room and light for making connections,

inspecting and cleaning the back of the board. The connections to the bus-bars, switches, etc., should be most thoroughly soldered or connected by heavy well-fitting bolts.

Considerable energy is frequently lost in imperfect contacts, and it should not be forgotten that the small area of contact or conductor necessary to carry the currents formerly used for telephone work are totally inadequate for the proper handling of the large currents used in the common battery systems.

It is to be regretted that the manufacturers of storage batteries are so interested at the present time with light and power equipments that very little information regarding the storage battery as applied to telephone service is available for the telephone engineer. Descriptive bulletins without number of central station and isolated lighting plants may be had for the asking, but, so far as the writer knows, nothing relating to telephone service has been published.

It is possible, however, that the fault is not altogether with storage battery manufacturers, but partly due to the reluctance of telephone companies to publish their plans of installation. This antiquated policy on matters of general interest to the profession is to be deplored. It has been abandoned to a great extent in the other branches of engineering, and there is no good reason for its continuance in telephone practice.

When noiseless dynamos of proper construction are used one of the batteries may be dispensed with to advantage, and the dynamo and central battery run in multiple, provided proper arrangements are made to take care of the increased pressure required during the period of charging.

The day of cheap and flimsy construction in telephone plants has gone by, and it should be unnecessary to state that all the generating apparatus of an exchange system should be of the best quality and located where there is plenty of light and space; and it should be borne in mind that such arrangements of circuits and insulation which might prove satisfactory where the entire generating plant is composed of a few cells of battery, is not at all adapted to present conditions in which the current is generated by dynamos or storage batteries of large capacity and considerable pressure. There are many other featurs in connction with the installation and operation of a plant of this character which can only be appreciated by those who have had experience in this branch of engineering. Ordinary business policy will therefore demand that the work be under the supervision of an engineer who has made this class of work a specialty.

Ganz Three-Phase Traveling Crane.

THE accompanying engravings illustrate a 20-ton traveling crane made for the Hungarian State Railway by Ganz & Co. of Budapest, and operated by three-phase induction motors.

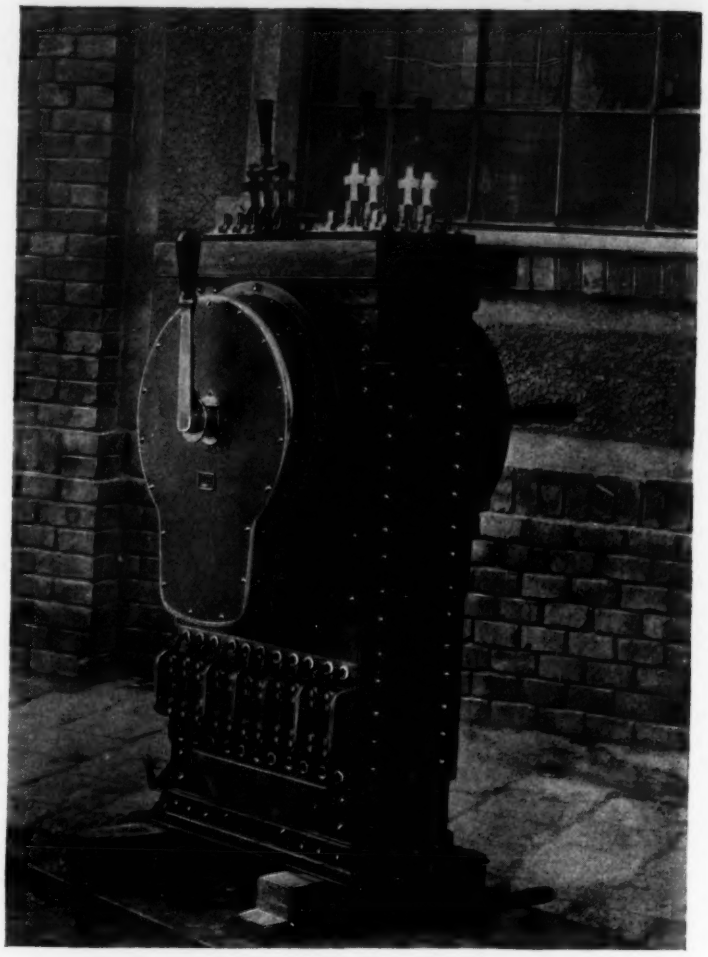


FIG. 2.—CRANE CONTROLLER.

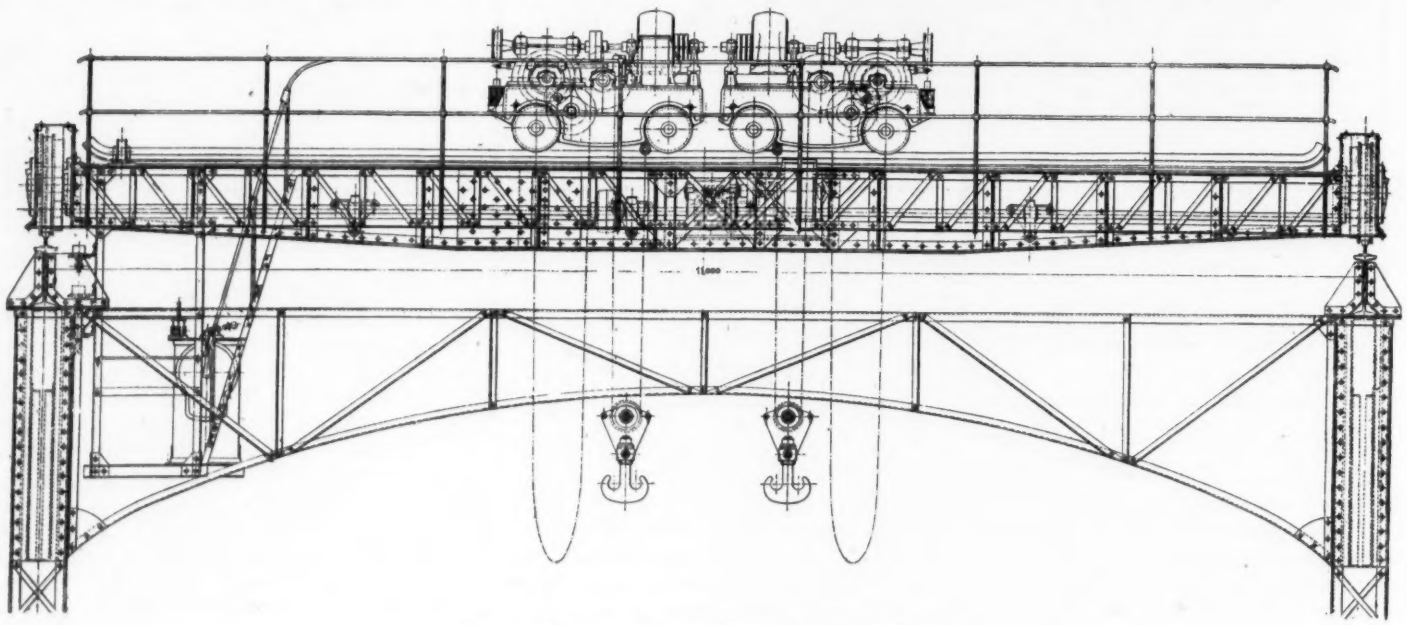


FIG. 1.—ELEVATION OF 20-TON TRAVELING CRANE.

The crane is provided with two 10-ton hoists, each of which has two motors, one of 12 hp for lifting the load and one of 3 hp for traversing. There is also an 8-hp motor for moving the crane itself. All of these motors are wound for 220 volts and a frequency of 42. The work of the hoisting motors is transmitted by means of a worm and wormwheel, and that of the traversing motor by a pinion and wheel gearing.

Each of the hoists is provided with a three-phase solenoid brake for holding the weight. If the current should be interrupted, the solenoid releases a weight on the lever of a band-brake, which latter then grips and holds the load. The moment, therefore, the hoisting motor is placed out of action the load is held by the action of the brake.

The load is lifted at a speed of 12½ ft. per minute. The travers-

ing speed of the hoists is at the rate of 60 ft. per minute, and the speed of the crane 130 ft. per minute.

The body of the crane is constructed of two double T-shaped riveted iron plate girders, secured to two box-shaped front girders; and two smaller girders, secured partly to the main girder and partly to the front girders.

The 8-hp motor for moving of the crane is placed in the middle of the crane body, below the walking-plank on a foundation resting on "U"-shaped irons. Its power is transmitted by means of a worm and worm-wheel in connection with symmetrically placed pinion - wheels transmitting to the crane wheels. The body of the hoists is of cast-iron

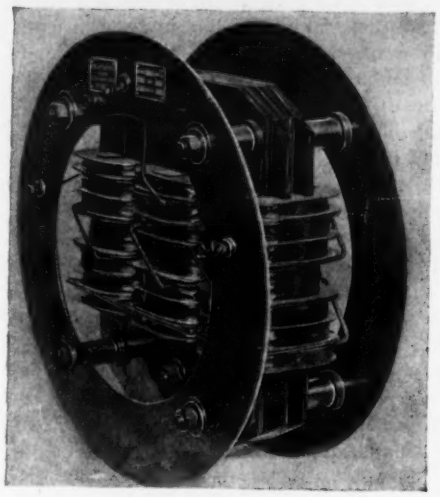


FIG. 3.—30-KW THREE-PHASE TRANSFORMER.

The current is conducted to this crane through three bare wires suspended along the line of the crane, the current being taken off by contact-rollers on which the conductors bear by their own weight, thus securing an efficient contact. From the rollers the current is conducted to the to the controllers, which are mounted in the operator's platform at one end of the crane under the horizontal beams. Thence the current is conducted by 16 bare hard-drawn copper wires suspended along the line of the crane.

The hoisting motors are provided with rings by means of which current is conducted to the primary part of the motor, which is the rotating part, the stationary or secondary part being connected to the controlling rheostat. All other motors are provided with short-circuited rotating parts, the current being conducted to the stationary primary part. There are for each hoist nine contacts, but as two of the six conductors can be united—since in the reversing of a three-phase motor it is only necessary to change the conductors—8 contacts are sufficient for each hoist, or 16 for the pair.

The motors for moving the crane are provided with current by means of insulated wires, which are mounted on the body of the crane. On the operator's platform are situated all switches as well as two controllers, all movements being regulated from this point. Fig. 3 shows the type of three-phase transformer used, which transforms the voltage from 2200 to 200 volts.

Transformer Incidents.

BY THOMAS W. VARLEY.

A TRANSFORMER is an electromagnet with a perfectly closed all-iron magnetic circuit. If now this circuit is strongly magnetized and the current which magnetized it removed, the iron will preserve its magnetic strength for a long time. It is in consequence of this effect that some peculiar results are obtained, which may seem puzzling and startling to the ordinary user of a transformer.

Suppose we take a transformer, on, say, a 25-cycle alternating circuit, and suddenly open the circuit while, say, the positive wave of current is at its maximum. This would leave the iron highly magnetized in a certain direction. Now, if the circuit is closed while the current wave is in a negative direction, this current has to demagnetize the iron and magnetize it in the opposite sense, and where

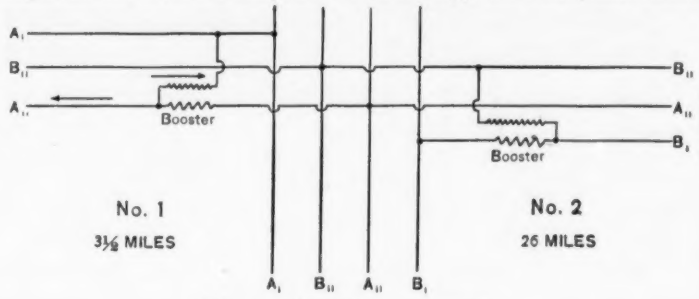


FIG. 1.—DIAGRAM OF CIRCUITS.

this takes place in the 50th part of a second, the rate of change of the magnetic field is so great that but a small current will flow on account of the counter e. m. f. This current is known as the magnetizing current.

Suppose now that instead of closing the circuit while the current would be negative, we closed it in such a way that the current wave would be positive or in the same direction as it was when the circuit was first opened. This positive wave could not magnetize the iron more strongly, at least not much more, and the rate of change of the magnetic field would be very slight; in fact, so slight that an enormous rush of current would take place while this positive wave lasted.

This effect has actually taken place, to my certain knowledge, in the case of a large transformer on 25 cycles where the normal current with secondary open is 30 amperes. The circuit can be opened and closed again, and in about once out of four times the rush of current was great enough to throw an 800-ampere circuit-breaker. It was such a serious matter that a water rheostat was introduced to allow the current to come up slowly to its normal value.

Another matter of some interest happened where there were two long underground circuits, one of 26 miles and one of 3½ miles, feeding from the same set of bus-bars, both using Stillwell boosters, as shown in Fig. 1. The two circuits were regular three-wire, two-phase. No. 1 circuit was boosting up as shown, while No. 2 could be boosted either up or down. Just so sure as a variable ground showed up on No. 2 circuit on the *A″* leg and discharged this *A″* leg disruptively, the booster in No. 1 circuit, which was on the same leg, would be exploded so violently that even the iron casing would be blown off, while the coils would be bent far away from each other. And this on a 30-kw transformer.

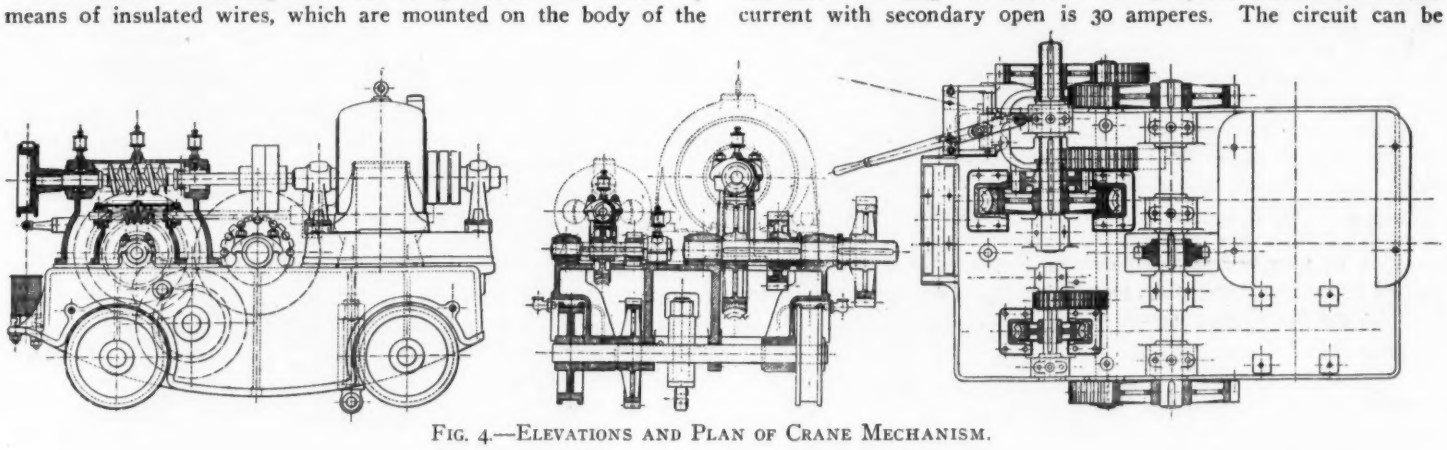


FIG. 4.—ELEVATIONS AND PLAN OF CRANE MECHANISM.

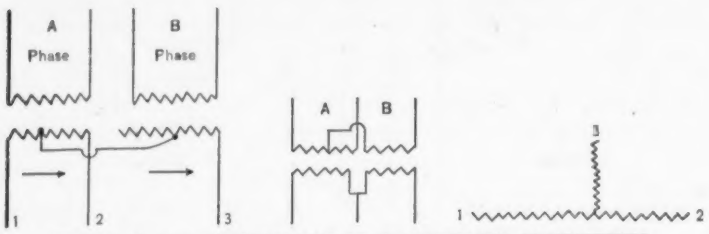
Dr. Pupin's Telephone Patents.

The Pupin patents on the art of reducing attenuation of electrical waves, Nos. 652,230 and 652,231, of June 19, 1900, have been reprinted by the Patent Office and copies can now be obtained once more. The recent acquisition of these patents by the American Bell Telephone Company has created a general interest in them, and led to a demand for them. They are an interesting contribution to telephone literature, and are referred to elsewhere in this issue.

When this effect had taken place four times in succession the booster of No. 1 circuit was changed from the *A"* to the *A'* leg. Since then no trouble has developed. This may be explained as follows: Suppose the voltage of *A"*, with respect to earth were, say, a positive maximum. This condition would give the greatest current to earth through the ground. If now the circuit were carrying its full load the current curve in the booster or transformer would be very nearly in step with the e. m. f. curve. As this discharge takes place very rapidly and would amount to a large current, it would re-magnetize the core in the opposite sense to what it was, leaving it in such a condition that the next e. m. f. wave of a negative direction would have no iron to magnetize. In consequence its c. e. m. f. would be next to nothing and its rush of current great enough to do the damage shown.

Another case of interest is in a plant where two-phase currents are generated, then stepped up and changed to three-phase currents by means of a Scott connection, as shown in Fig. 2.

On open circuit the voltage between 1 and 2, 2 and3 and 1 and 3 is similar, but when loaded up so that each leg of the three-phase



FIGS. 2, 3 AND 4.—DIAGRAMS OF TRANSFORMER CONNECTIONS.

carries the same current the voltage of 1 and 2 and 2 and 3 is similar, while that between 1 and 3 may be 15 per cent less. This same effect takes place where the two-phase three-wire service is used with the connections like in Fig. 3. Also in the monocyclic system where a winding is brought out midway between the main windings like in Fig. 4, and connected to the center of the main winding the same trouble will be found in keeping the phases balanced, for the balancing will be different for all loads.

In changing from two-phase to three-phase with the Scott connection, if a number of taps were brought out to one side of the center so as to be able to vary the connection with the load, this unbalanced effect would be entirely overcome.

This might be explained as follows: The transformer on the *A* phase has a wave of current from 1 to 2 in the direction of the arrow, which, as it dies out, leaves the core magnetized in a fixed direction. As it dies out a wave of current starts through the transformer on phase *B*, as shown by the arrow, whose return path is from the center of the transformer on phase *A*. If its path through *A*, by way of leg No. 1, is in the same direction as the previous current from 1 to 2, it will be a much better circuit than that by way of leg No. 2, which would have to oppose the previous state of affairs.

These are but a few of the many incidents that take place in the operation of transformers, and though simple enough if explained, which I hope is done correctly, may and do cause a good deal of hard thinking and ingenuity to overcome.

American Municipal Debts.

New York City's debt was $489,905,900 on Jan. 1, 1901, an increase in one year of $31,000,000. Three years ago the net public debt of Chicago was $17,013,000. It is now $26,332,000. Th debt of Baltimore, which was $15,000,000 three years ago, is now $31,000,000, and the debt of Boston, which was $49,000,000, is now $56,000,000. Within three years the debt of Philadelphia has increased from $34,000,000 to $43,000,000. The debt of Rochester has increased from $8,400,000 to $10,002,000, and of Buffalo from $13,200,000 to $14,100,000. Three years ago the debt of Cleveland, Ohio, was $6,200,000; it is now $9,200,000. In the same period the debt of Columbus increased from $3,500,000 to $6,000,000; of Detroit from $3,500,000 to $4,600,000; of Indianapolis from $2,000.000 to $3,000,000, and of Kansas City from $3,700,000 to $4,600,000. The rapid increase of such indebtedness is becoming a cause of serious alarm, which may presently check the growth of municipal enterprises, and leave more to private initiative.

The Forerunner of the Telephone.

BY EDWARD A. CALAHAN.

THAT the conservative management of a bank inspires more confidence in the depositors than the amount of the bank's capital, surplus or the great names among its board of directors, is too well known to dispute. The introduction of a stock ticker into a bank in the year 1869 was, or would have been, equivalent to placing a keg of gunpowder underneath the vault, or establishing a Monte Carlo outfit in a side room. The bank loaned its thousands daily on stock collateral with its fluctuating value. It had no means of knowing the condition of the market except by such methods as were in use before the advent of the stock ticker.

No one realized this disadvantage more than the late William A. Camp, who was then and for many years afterward the manager of the New York Clearing House. He early became an enthusiastic stock holder in the Gold & Stock Telegraph Company. Through his energy and perseverance he secured for that company about 48 of the 60 banks which at that time were members of the Clearing House Association as subscribers to a system of telegraphy by which each bank could be placed in communication with the Clearing House, especially in order to procure as early in the morning as possible its daily balance. Also, to be enabled to communicate with any other bank in the system, and on Saturdays to receive the bank statement (which was compiled at the Clearing House) before it became known on Wall Street. All these things and more were provided by our company.

The instrument adopted for this purpose was one invented by myself, and will be remembered as the "Bank Printer" (Figs. 1 and 2). It was particularly desired that there should be no figures or fractions on the typewheel, and that it should in no way resemble or be mistaken for a stock ticker. It was of necessity a single-wire printer. Each and every bank had its own wire to the Clearing House, and being insulated the cost of construction was far greater than the cost of the apparatus, the reverse of the conditions of the stock ticker system. Each bank was provided with a transmitter and a receiver.

The Transmitter was practically the same as that shown in the article entitled "Evolution of the Stock Ticker," published in the ELECTRICAL WORLD AND ENGINEER, Feb. 9, in which two are shown, one for each wire. In this case only one was used, and contained but 15 contact points instead of 30, the make and break being equally effective. The pointer was turned with moderate speed and uniformity, stopping suddenly opposite the letter desired when the impression would be taken on the receiving instruments at both ends of the line. This transmitter is better explained in the diagram of the switch, Fig. 3.

The Receiver.—The motive power was a weight and clockwork, a ratchet or escapement wheel, and the well-known form of pallets. This receiver could be worked up to the fullest capacity of the operator, who was limited through the inefficiency of the transmitter. The more rapid the revolutions were the more perfect was the work. A small independent or secondary piece of clockwork was kept in motion, while the typewheel was revolving. A sudden pause on the part of the typewheel would cause this piece of mechanism to close two contact points, which brought the press magnet into circuit and broke this circuit an instant later, leaving the typewheel free to move. This device was readily adjustable, in order to conform to the speed of the different operators.

The Switchboard.—To bring all these requirements into practical use a switchboard was necessary. There was nothing suitable on the market, and therefore one had to be made for this purpose. Fig. 3 is a slightly modernized or condensed copy of the original working drawing made by me in the year 1869. For convenience in describing this switch, six banks only are shown connected with the Clearing House, or what would now be called "Central." Each line was connected with its own spring jack, *S. J.* When simultaneous transmission was required, as in the case of the "Bank Statement," or other important news which would be interesting to all banks, a movable bar or multiple switch, pivoted at both ends, would be brought down to the spring jacks. Six wedges, which were electrically connected together and permanently attached to this bar, were inserted between the spring jacks. Each of the six banks were thus brought into connection with the contact points of a relay, main battery, sounder and to earth. The relay magnet was in a local circuit with a transmitter and local battery. The wedges, as shown, were made of an insulating material on one side.

This multiple switch was continued along the board so that any operator could transmit simultaneously to any group of six banks, which groups were selected as to distance from the Clearing House, and resistance of the circuits without interfering with other operators performing the same service. The bar being removed, the spring jacks were pressed together and the normal condition of the system restored.

The circuit can now be traced from the bank which is, of course, at earth to *S. J.*, its sounder, main battery and earth.

In this condition a bank would call *C. H.* by simply turning the transmitter one revolution. This was received on a sounder connected with and numbered to correspond with the number of that bank. *C. H.* would insert wedges P^1 into the spring jack of that number, and so substituting the printing apparatus for the sounder, when local communication would take place. The daily balance and the prices of stocks were usually all that would be required.

Intercommunication between banks was much more frequent. The sounder of No. 10, for instance, would buzz. *C. H.* would answer as above. No. 10 would simply say 56. The two wedges, *P. P.*, would be inserted in jacks 10 and 56, thus connecting the two banks, through a special battery and sounder at *C. H.* The sounder was used to notify the *C. H.* operator that the two banks had "finished"; or if either of them was wanted by another bank while they were communicating the third bank would be informed that the bank wanted was "busy."

There was quite a demand for "private" lines in consequence of the successful working of the bank system; but the subscribers were not connected with any bank nor with the Clearing House, which was a "close community." The Gold & Stock Telegraph Company found it necessary to establish a separate department for the development of this industry, which was known as the "Private Line Department." It will be plainly seen that everything in switching, such as is used to-day, was done at the Clearing House seven years before the invention or discovery of the telephone. The words and phrases, such as "hold the wire," "finished," "busy," etc., were in use then as they are now. When we wanted to say, "Hello!" which was very seldom, we would spell it, as we also did when we wished to express laughter by spelling "Ha! ha!"

It never at that time occurred to me that there was any particular novelty in such a switch as described. It was common practice in a telegraph office to switch a wire on or off of different sets of instruments. I believe there was no system known at the time where all wires led to a central office, and were worked to it, from it, and through it simply or in multiple.

A Mr. Coy, of New Haven, who was evidently not aware of the

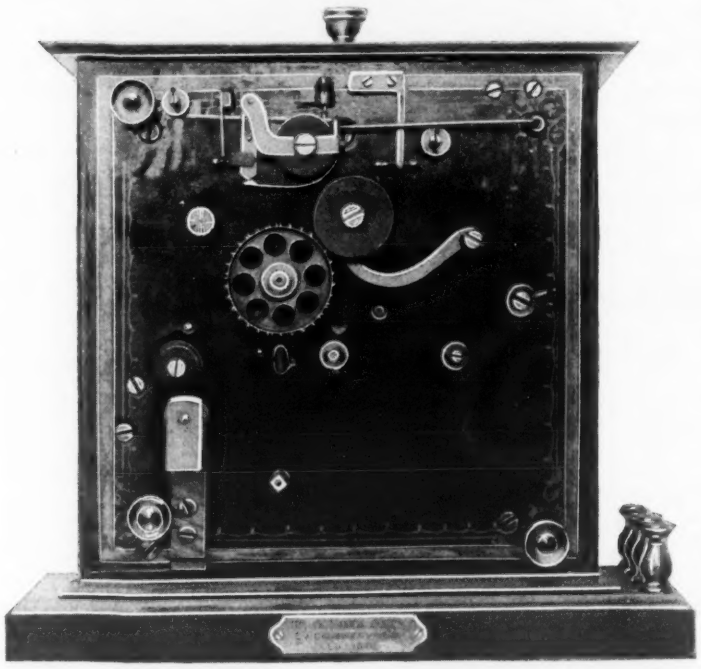


FIG. 1.—THE BANK PRINTER, FRONT VIEW.

details or even the existence of the "Bank System," applied for and obtained a patent for substantially the same switch after the telephone had become a substantial fact, and brought suit against the Bell Company for infringement of his patent. The Bell Company learned of my prior invention and use of the switch, and instead of

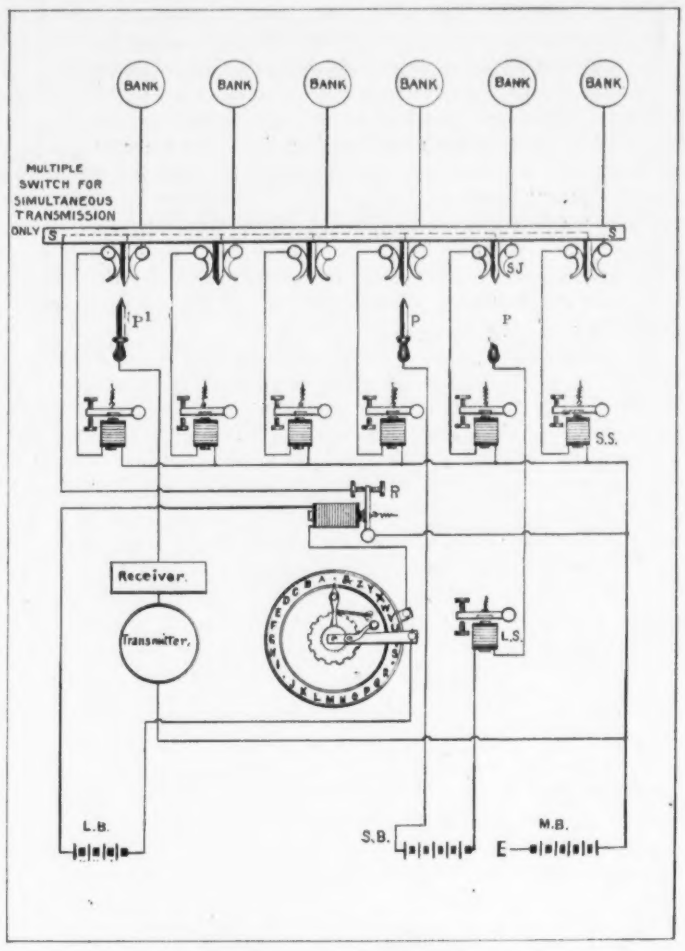


FIG. 3.—SWITCH FOR BANK PRINTER.

meeting the question in court they discovered through the records of the Patent Office that Mr. Coy had transferred to a certain party in New Haven one-twelfth of the patent in consideration of money advanced for the cost of obtaining it, and quietly purchased his interest, which gave it the right to use it, as it would have given any one else owning a small fraction of it; but as there was no other telephone at that time there could be no possible use for the other eleven-twelfths remaining, and Mr. Coy was simply frozen out.

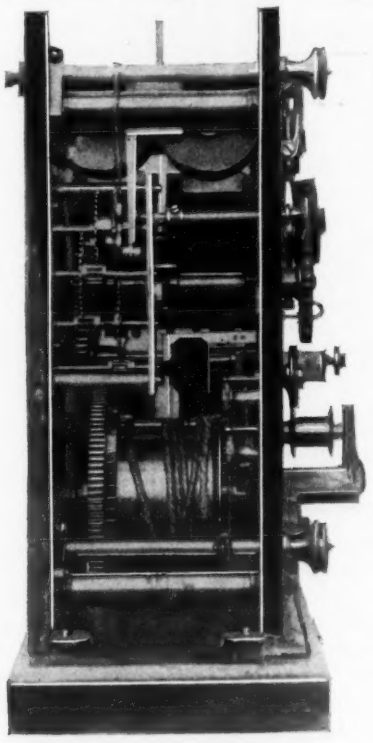


FIG. 2.—THE BANK PRINTER, SIDE VIEW.

It might be interesting to the many friends of Mr. George L. Wiley to note the fact that it was in this "Central" that he took his first lessons in telegraphy, and being an exceedingly apt scholar he prepared himself to introduce telephony into Mexico.

The great whaling industry of New Bedford was practically destroyed within a week after the discovery and introduction of "coal oil," as it was then known. This bank and private line system was literally wiped out in about the same length of time by the telephone. Thus changes come, but in the long run they are for the general good of the public.

Tesla and Wireless Telegraphy.

THROUGH the New York *Sun*, Tesla announced last week that he is about to begin the construction of a plant for telegraphing without wires across the Atlantic Ocean, and that he estimated the work of preparation will consume eight months, adding, however, "but I am prepared to encounter some delays and drawbacks which always turn up somehow." From a statement in the same journal, it appears that the system to be employed was the subject of a patent issued to Tesla in May of last year. In looking over our files we find that two patents on "apparatus for transmission of energy" were issued to Tesla last spring, one dated March 20, and the other May 15; the latter is the one referred to by the *Sun*. We reproduce the following analyses of the patents from our issues of March 31 and May 26, 1900, respectively:

The patent dated March 20 (application filed Sept. 2, 1897), relates to the production at one point of an electrical pressure of such character and magnitude as to cause thereby a current to traverse elevated strata of the air between the point of generation and a distant point at which the energy is to be received and utilized. As illustrated, the apparatus consists of a generator supplying current to the primary of a transformer; the secondary consists of a coil of many turns and is connected at one side to the earth and at the other side to a terminal of large surface, maintained at a high elevation by such means as a balloon. The receiver duplicates this apparatus, except that instead of a generator being in one circuit of the transformer, receiving devices such as lamps and motors take its place.

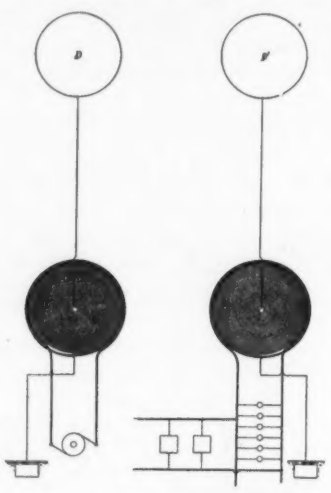


DIAGRAM OF TESLA APPARATUS.

The transformer consists of a coil of very large diameter wound in spiral form, either with or without a magnetic core. The inventor claims that this furnishes a practical method or system of transmission of energy through natural media without the use of wires.

The patent of May 15 (application filed Feb. 19, 1900), is on "apparatus for transmission of electrical energy." Referring to the accompanying illustration, which is a duplicate of that appearing in the patent of March 20, *DD'* are terminals of large surface maintained by such means as a balloon at a high elevation, the elevation depending upon the amount and quality of the work to be performed, the condition of the atmosphere, and also by the character of the surrounding country. The aerial conductors to these terminals are connected to the secondary of a spiral coil, the other end of the coil being connected to earth.

It is stated that the length of the thin wire in each of these coils should be approximately one-quarter of the wave length of the electric disturbance in the circuit, this estimate being based on the velocity of the propagation of the disturbance through the coil itself and the circuit with which it is to be used. For example, if the rate at which the current traverses the circuit including the coil be 185,000 miles per second, then the frequency of 925 miles per second would maintain 925 "stationary moves" in a circuit of 185 miles long, and each wave would be 200 miles in length. For such a low frequency, a secondary 50 miles in length would be used.

As will be noted from the illustration, the primary of the transmitting coil is supplied with a current by a dynamo, and the large coil of the receiver is connected with a circuit including lamps and motors. It is stated that the phenomenon involved in the apparatus is one of true conduction, and not to be confounded with the phenomena of electrical radiation which have heretofore been observed, and which from the very nature and mode of propagation will render practically impossible the transmission of any appreciable amount of energy to such distances as are of practical importance. The specification states that if the potential is sufficiently high and the terminals of the coil be maintained at the proper elevation where the atmosphere is rarefied, the stratum of air will serve as a conducting medium for the current produced, and the latter will be transmitted through the air "with, it may be, even less resistance than through an ordinary conductor."

Independent Telephony in Cleveland.

The annual meetings of the Cuyahoga Telephone Company and the United States Telephone Company, of Cleveland, were held in that City Feb. 4. Directors were elected as follows: H. A. Everett, E. W. Moore, John Sherwin, H. Clark Ford, J. B. Hanna, F. M. Stearns, C. W. Wason, R. A. Harman, Barney Mahler, T. F. Pomeroy and Mark Davis. The officers of both companies are H. A. Everett, president; E. W. Moore, vice-president; James B. Hoge, secretary; John Sherwin, treasurer. Mark Davis is general manager of the Cuyahoga Company.

In his report, President Everett said that after six months operation the Cuyahoga Company has more telephones than the Bell Company had when the Cuyahoga Company started construction in July, 1899. The present number of direct lines connected up is 5735; 2119 contracts now on the waiting list are being rapidly supplied. Party lines have been carefully avoided, as they are unsatisfactory. New contracts are coming in at the rate of 100 to 150 per week. The strongest points in the independent telephone movement, he said, have been (1) reduction of rates to a fair basis, (2) superior service and (3) local influence of its stockholders.

"In addition to the local business," Mr. Everett continued, "we are pleased to say that the long distance connections are rapidly assuming a very comprehensive aspect, and at the present time we can reach over 30 per cent more telephones in the State of Ohio than can the Bell Telephone Company. The independents have 332 exchanges in Ohio and the Bell 129; 1300 toll stations to the Bell's 594, and 66,000 subscribers against the Bell company's 47,000. Within a very short time we shall be able to talk to Pittsburg, which has a fine new exchange, and will connect with the Western Pennsylvania system; also with Indiana, West Virginia and Kentucky.

"The Cuyahoga Company was organized Sept. 13, 1898, with a capital stock of $3,000,000, and with bonds outstanding to the amount of $2,000,000. We are pleased to state that at the present time the company is earning more than 5 per cent on its entire cost, and as soon as contracts that are now waiting are connected, we will be able to earn a moderate surplus on the capital stock.

"In the early days we made the usual mistake of thinking that facilities as great as those of the Bell Company would be sufficient, but our original contract for 20 per cent more telephones than the Bell Company had in use has been exceeded, and has caused us not a little worry and annoyance in not being able to supply promptly in all districts the unexpected demands of our subscribers.

"We are pleased to say that, on the whole, the business has been far in excess of our expectations, and that there is large enough field for the independent companies to make a handsome profit when operating in straight competition with the Bell Company."

The Wisconsin Independent Telephone Association.

The State Independent Telephone Association held a meeting in Madison, Wis., on Feb. 13 and 14. The following officers were elected; President, A. L. Hutchinson, of Weyauwega; vice-president, C. P. Schweiser, of La Crosse; secretary and treasurer, H. C. Winter, of Madison. Executive Committee: Richard Valentine, of Janesville; F. H. Sweet, of Fond du Lac; J. C. Harper, of Madison; J. A. Gaynor, of Grand Rapids; W. F. Gunaer, of Appleton. It was decided to hold an adjourned meeting at La Crosse in June and the next annual meeting in Milwaukee in February. A visit was made to the University of Wisconsin, where the members attended a lecture by Prof. Trowbridge on "Wireless Telegraphy." Resolutions were adopted against the passage of the Rossman bill regulating telephone rates, and in favor of requiring telephone companies to connect their lines and exchange messages. Thirty-six companies were represented and fifty delegates were present. Twelve new companies were admitted to the association.

The Origins of the Telephone and Phonograph.

Prof. T. C. Mendenhall contributes to the admirable series of articles in the New York *Sun* reviewing the last century, one on physics. It runs a length of seven columns, of which two are devoted to electricity and magnetism. After discussing the scientific principles and discoveries relative to telegraphy, Prof. Mendenhall says: "Faraday's discovery of induction furnished the basis of that marvelous improvement upon the telegraph by which actual speech is transmitted over hundreds and even thousands of miles. In connection with the invention of the telephone the names of Philip Reis, Graham Bell, Elisha Gray and Dolbear will always be mentioned, each of whom, doubtless independently, hit upon a way of accomplishing the result with more or less success. To Bell, however, belongs the honor of having first practically solved the problem and of devising a system which, with numerous modifications and improvements, has come into extensive use in all parts of the world. No other application of electricity has come into such universal use and none has contributed more to the comfort of life.

"While it is doubtless true that since Faraday's time no discovery comparable with his in real importance has been made, the past 25 years have not lacked in results of scientific research, some of which may, in the not distant future, eclipse even that in the value of their practical applications. Among these must be ranked Clerk Maxwell's theory of electric waves and its beautiful verification in 1888 by the young German physicist, Hertz. This brilliant student of electricity succeeded in actually producing, detecting and controlling these waves, and out of this discovery has come the "wireless telegraphy" which has been so rapidly developed within the last few years. Many other discoveries in electricity of great scientific interest and practical promise have been recorded in the closing years of the century, but the necessary limits of this article forbid their consideration.

"No account of the progress of physical science during the nineteenth century would be even approximately complete without mention of other investigations of profound significance. For instance, the study of the phenomena of sound has yielded results of great scientific and some practical value. The application of the theory of interference by Thomas Young; the publication of Helmholtz's great work, the *Tonempfindungen*, in which his theory of harmony was first fully presented; the publication of Lord Rayleigh's treatise; the invention and construction by König of acoustic apparatus, the best example yet furnished of scientific handicraft; all of these mark important advances, not only in acoustics but in general physics as well. The phonautograph of Scott and König, by which a graphic record of the vibrations of the vocal cords was made possible, was ingeniously converted by Edison into a speech recording and reproducing machine, the phonograph, by which the most marvelous results are accomplished in the simplest possible manner."

Bell Telephone Expansion.

Some figures compiled recently in Boston give an excellent idea of the rapid growth of investment now going on in the Bell telephone industry. To this list subjoined might be added other items, however, such as the money put lately into the Erie properties, while it may be stated that on the New York and New Jersey systems large sums are being spent. In Chicago also the Bell Telephone Company estimates its expenditures on new work in 1901 at $2,000,000, and will probably issue the new stock, pro rata, in April and October.

The Rocky Mountain Bell Telephone Company, operating 32 exchanges in Utah and Montana, has increased its capital stock from $842,000 to $2,500,000 for improvements. The new stock will be issued as funds are required. The Central District & Printing Telegraph Company, of Pittsburg, has voted to increase its capital stock from $4,000,000 to $7,500,000 for further development of the territory. The Hudson River Telephone Company, operating in Albany, Poughkeepsie, Saratoga and other points in northern and eastern New York, will increase its capital stock from $3,000,000 to $4,000,000 for construction purposes. The capital stock was increased $1,000,000 last March. The Chesapeake & Potomac Telephone Company operating in Washington, D. C., and the State of Maryland, has made an additional issue of $750,000, 5 per cent bonds, making total issue to date of $1,250,000. The total authorized issue is $1,500,000.

At the time of the consolidation of the several subsidiary telephone organizations making up the New England Telephone Company in 1883, $4,058,400 stock was issued to the American Bell Telephone Company for franchises, etc., and $5,842,800 to other stockholders, making a total capital of $9,901,200. Up to March 31, 1900, the capital has been increased for extensions and development to $13,759.100 and bonds and debts created amounting to $4,387,866. Add the probable cost of new extensions in 1900, estimated at $2,000,000, and the total amount of capital employed to-day will be $20,146,966.

Mr. J. P. Morgan in British Traction.

A special cable dispatch from London, of Feb. 16, says: "J. Pierpont Morgan has entered the English electric railway field. The prospectus of the British Electric Traction Company with a capital of £2,000,000, was issued a few days ago, with the notice that J. P. Morgan & Co. guarantee the underwriting of £350,000 preference shares, which were offered to the public at a premium. Morgan gets an option of taking £800,000 of the company's capital, which will not be offered for allotment just at present. The company is to combine numerous newly started and proposed electric railways in 40 English provincial towns and also in some suburbs. A London member of the Morgan banking house said he believed England's congested districts, with their great populations, and the numerous closely lying cities afforded a fine field for the development of electric traction."

The British Traction Company is a concern well known in American electrical circles. The business of the company consists of the financial promotion of all kinds of electric railway undertakings including the acquisition of Parliamentary charters for new lines, the extension of existing properties and the conversion of horse-power roads into modern electric systems. The company, it was said, since its organization in 1896, has built upward of 50 roads in the United Kingdom. It is reported that among Mr. Morgan's associates in the transaction are Sir Charles Rivers Wilson, president of the Grand Trunk Railway; Sir Charles Fremantle, the British director of the Suez Canal, and Lord Rathmore, a privy councillor.

An Institute Conversazione.

Encouraged by what has been accomplished by other technical societies, and what they have recently seen abroad, the Council and Committee on Meetings of the American Institute of Electrical Engineers have arranged for a conversazione to be given by that body some time in April. Through the courtesy of Columbia University, the conversazione will be held in the electrical engineering department, with the co-operation of Prof. Crocker, Dr. Pupin, Mr. G. F. Sever and others of the staff there, and so much interest has already been shown in the matter that a brilliant success is forecast. While the conversazione will be largely social in character, a special feature will be the exhibition of latest electrical apparatus, inventions, etc., in working condition. Mr. T. A. Edison, Prof. Elihu Thomson, Dr. Pupin and others have promised personal assistance in this respect, and as Mr. W. J. Hammer has that part of the programme in hand, and is working hard, it is believed that the demonstration will be one of the best of this kind ever seen in this city, especially as the electrical resources of the University will also be available. Secretary Pope and Mr. W. S. Barstow, chairman of the Papers and Meetings Committee, extend through the press an invitation to all members to contribute features of scientific interest and to give an early notification of what they will do in this respect.

New Headquarters for the Automobile Club of America.

In a quiet and dignified fashion the new clubrooms of the Automobile Club of America, at Fifty-eighth Street and Fifth Avenue, were thrown open to the members on the afternoon of Feb. 16, and an informal reception was held at night. The location, looking out upon the Plaza and the Park, is admirably situated for the owners of automobiles, and all club runs will start from the Plaza hereafter. The new quarters are immediately over the Plaza Bank, and occupy the entire second floor of the building. The furnishings are handsome and particularly appropriate. The main room, which overlooks the Plaza, is handsomely fitted up, the prevailing color being automobile red. It is well suited for lecture purposes. Just off it is a pretty library, with writing facilities, and committee room.

The Dutch, or grill, room is in the rear, where the members sit, chat and eat at their leisure. There is no bar attached to the club, and members desiring liquid refreshments are provided with lockers, which they can supply as their fancy dictates. No storage has been provided for automobiles, and none will be, at least for the present. There are several automobile storage places in the immediate neighborhood.

At the evening reception there was an excellent attendance of members. President Shattuck delivered a brief address of welcome, and stated that the club had moved, fitted up its new quarters and had a balance on hand, after all expenses were paid, of $4,000. He gave some details of the recent work of a public character in which the club had taken a leading part. His remarks were followed by a collation prepared under the supervision of the acting chairman of the House Committee, Mr. J. M. Hill, who, with the other officers, is greatly to be congratulated on the success of the evening, and of the club opening in general. Among the electrical people present were R. McA. Lloyd, J. M. Hill, C. E. Corrigan, H. Ward Leonard, C. J. Field, E. T. Birdsall, T. C. Martin, A. H. Whiting and F. Hird and R. Dumas, of London, England. Arrangements have been made by President Shattuck for some early lectures.

Russian Duties on Electrical Apparatus.

Owing to the belief or claim that Russia pays a sugar bounty, the duties on Russian sugar imported into this country have been increased. This has immediately been followed by an ordinance from the Russian Finance Minister, M. de Witte, increasing duties on American importations of machinery into Russia, 30 per cent. It is believed that a grave crisis has been reached in the trade relations between the United States and Russia. The immediate effect of the Russian decree, when it becomes operative on March 1, will be to increase by 50 per cent the duties on American machinery, steel and iron goods. These goods already enjoy two separate reductions, 30 per cent being taken off from the general and 20 per cent from the conventional duties. The articles referred to in the Russian decree are machinery and tools, and manufactures and products of cast iron and steel. Roughly stated, the United States is said to have exported goods of this description to Russia last year to the amount of about $30,000,000. The addition of 50 per cent to the duty will, it is thought, prove practically prohibitory.

The text of the Russian order is as follows: "An order of the Russian Minister of Finance directs additional tariff of 30 per cent net imposed upon articles included in Paragraphs 150, 151, 152, 153, 161, and Section 2, discriminating tariff, upon American hardware, iron, steel, boilers, pipes, forgings, castings, tools, gas and water meters, dynamos and sewing machines, (Paragraph 167) of the Russian tariff laws when such articles are of American manufacture. This includes motors and machinery of all kinds.

State Control of Lighting Companies in New York State.

A bill has been introduced by Assemblyman Bedell placing all the gas, electric light, heating and power companies of New York State under the control of the State Railroad Commission. It will indirectly make the board the arbiter of the price of gas and electric light in the various cities of the State. It will practically compel new electric light, heat and power companies to obtain the consent of the commission before they can commence business. It will prevent the same class of companies discontinuing a part of their service, if they deem it no longer profitable, should the commission decide that such service must continue. The bill amends the State railroad law by adding to the powers of the State Railroad Commissioners a general supervision of "corporations formed for supplying gas, or for electric lighting, heating or power purposes." Such companies are to be treated the same as the present law directs the commission to treat railroads—that is, the commission "shall examine the same and keep informed as to their condition and the manner in which they are operated for the security and accommodation of the public and their compliance with the provisions of their charter and of law. The commissioners or either of them may enter and remain during business hours in the offices and plants of all corporations, subject to its jurisdiction, and examine books and affairs of any such corporation and compel the production of books and papers."

The greatest increase of power to the commission by the bill is the inclusion in the present railroad law of the illuminating companies, with reference to the board's recommendations concerning the latter. Section 161, which is amended to so include illuminating companies, says:

"If, in the judgment of the board, after a careful personal examination of the same, it shall appear that any corporation formed for supplying gas or electric lighting, heating or power should furnish additional facilities for the convenience or accommodation of its patrons, or should reduce its charges for gas or for electric light, heat or power, or should otherwise modify the methods of conducting its business, the board shall give notice and information to the corporation of the improvements and changes which they deem to be proper."

Under the proposed law the commission can grant hearings upon application for the reduction of the price of gas and electric light. Legislative lawyers also construe the powers of the commismissioners under the Bedell bill to include the power to deny the right of a new corporation to lay mains of wire conduits that may parallel any other company. Should this construction be sound, the State Railroad Board will have the right to say whether or not at any point in the State new gas pipes or electric light poles or conduits shall be established.

CURRENT NEWS AND NOTES.

ELECTRICAL EXECUTIONS IN INDIANA.—A correspondent in Indiana informs us that the Indiana Senate has voted to adopt electrical means for inflicting capital punishment in that State.

IMPROVING THE PRESS.—The Correspondents Club of New York, having invited opinions as to increasing the good influence of the press, got the following among others: Thomas A. Edison—"By publishing a fact now and then." Nikola Tesla—"The influence of the press might be greatly increased by adopting a better system of informing the world of technical and scientific advances."

TROLLEY FUNERALS.—The St. Louis Liverymen and Undertakers' Association are discussing a complaint of its president, Louis Spellbrink, against the Transit Company, which has been operating a funeral car. On this account the liverymen felt that their business was being invaded. President Spellbrink says that his association has adopted a rule that any of its members who act in conjunction with non-members shall be expelled. As the funeral car cannot run into the cemeteries provision must be made for the conveyance of the corpse and mourners after they have arrived at the borders of the cemetery. Mr. Spellbrink says that there are 103 members of his association, none of whom will do this work. The immediate cause of the liverymen's action was the recent funeral of a nephew of George W. Baumhoff, manager of the Transit Company. Mr. Spellbrink says that this was conducted by an undertaking company, one of whose members is a relative of Mr. Baumhoff, after another firm refused to take charge because of the intended use of the funeral car.

TRADE WITH CHINA.—A special cable dispatch to the New York *Sun* of Feb. 8, says: "Exceptional importance is attached here to the 41st annual congress of the British and Irish Chambers of Commerce, which is to be held in London in the middle of March. The Chinese question will hold a very prominent place in the deliberations of this body, which is truly representative of the commercial community. As practical men a majority of the delegates strongly object to the manner in which England has been acting in the Far East. They believe that instead of pressing fantastic schemes of vengeance and exorbitant indemnity demands upon the wretched Chinese Government, advantage should be taken of the evident willingness of that Government to give increased trading facilities in the vast, unknown regions of the Empire, and the congress will be asked to appoint a deputation to wait upon the Marquis of Lansdowne, Minister of Foreign Affairs, to urge these views. It is believed that the congress will also call upon the British Government to buy out the Eastern Cable Company and allied subsidiary concerns in order that the entire cable system of the mother country with the colonies and dependencies shall be in the hands of the Imperial administration. This scheme is very big, but business men consider practical this project which would yield a comfortable profit to the State, irrespective of the undeniable political advantages.

STREET RAILWAY FRANCHISES.—A controversy over the extension of a franchise in Columbus, Ohio, has been settled by a compromise. The ordinance provides for straight cash fares at 5 cents, seven tickets for 25 cents, with transfers, until the gross receipts of the company reach $1,750,000, and after that eight tickets for 25 cents, with transfers. All-night cars are to be operated on four of the principal lines, under a schedule of 10-cent fares, with transfers, for the first five years, and under a 5-cent schedule with transfers for the remaining years of the life of the franchise.

LONDON'S UPTORN STREETS.—A special dispatch from London, of Feb. 16, says: "A week ago the indignation of Londoners over the inconvenience and loss caused by the long barricading of the streets in the business part of the city while a new telephone system and electric lighting apparatus were being installed found voice in a protest in a committee which was elected by the omnibus railway companies and trades people. As a result the City of London Corporation ordered the street operations continued night and day. This order has now been modified so as to apply to the main streets only. As every thoroughfare in London must be taken up the condition of things is serious, and all business seems destined to suffer from an indefinite prolongation of the trouble. Strenuous efforts are being made to secure the intervention of Parliament.

SHAWINIGAN FALLS POWER.—The first power at Shawinigan Falls, Quebec, was turned on Thursday, Feb. 7, and the town, which two years ago did not exist, but now has a population of over 3000 persons, was lighted by electricity. The generator first supplies a comparatively small amount of power, but it constitutes the initial step in a development of electric energy which promises to be the greatest in the world. The initial use of electricity at Shawinigan is notable in that the development of power from water there, with the exception of Niagara Falls, offers more scope than any other point in the world. The company has completed the hydraulic development of 75,000 hp, which is about 25,000 more than has as yet been developed at Niagara. An electrical installation for 10,000 hp is being put in place, from which the company proposes to take its supply for the city of Montreal.

TRANSFER APPARATUS FOR STORAGE BATTERIES.—Two patents were granted Feb. 12 to C. O. Mailloux on apparatus for the transfer of storage batteries to and from street cars and automobiles, and for the handling of the batteries in a charging station. Among the principal features are the application of power-driven mechanism to the insertion or withdrawal of the battery or trays from the vehicle; an adjustable drawbridge for supporting the batteries in transit to and from vehicles; a transfer carrier and transfer table with tracks from the latter to a series of charging racks, etc. All operations requiring power are performed by means of electric motors. The specifications describe the numerous details with references to 51 illustrations on 20 sheets of drawings. The two patents contain 49 claims, those of one relating to the mode of transfer between the vehicle and carrier, and of the other between the latter and the charging racks.

A TWISTED TELEGRAPH LINE.—A strange condition of affairs has developed, it is said, in connection with the construction of the Yukon telegraph line from Quesnell, B. C., to Telegraph Creek and Atlin. Construction was completed between Quesnell and Hazleton, and then a party was sent out from Hazleton to continue construction north while simultaneously another party was started out from Telegraph Creek to work south, and make connection with the Hazleton party about half way between those two points. In their work one party struck along a certain valley, and the other party along an entirely different valley. The result is that the actual work of construction has overlapped, but instead of the wires being connected, the ends are 70 miles apart, with two gigantic ranges of mountains intervening. The result must be the destruction or abandonment of a large portion of the line already built and the building of a new line.

CANADIAN TELEGRAPHS.—The Dominion Government has, it is stated, taken steps to purchase the telegraph systems of Canada, extend them enormously and operate them in connection with the Post Office Department. It is also seriously proposed to follow a similar course with the telephone, but in the case of the latter municipalities will be licensed, as in Britain, to operate the system within their own areas. The question of the absolute control of the Canadian telegraphic service has long been discussed, but not until the present Liberal Government came into office has it been possible to talk of purchase. With a surplus running from $6,000,000 to $7,000,000 for 1900-1901 and a prospect of an equally large surplus for 1901-1902, the plan seems feasible. A submarine cable scheme is included in the general plan. The Canadian Pacific telegraphs are said to be worth $7,000,000, the Great Northwestern about as much, and the Bell telephone system at least $5,000,000.

BUCKET-SHOP TAXATION.—It is said that the action of the Senate Committee on Finance in proposing a tax on bucket-shops has called attention to the extent of the business of irregular stock speculation. It is said that a tax of $400 a year upon these establishments would yield $10,000,000 in revenue. Considerable opposition to the bucket-shop tax has been aroused among the brokers and Board of Trade men generally. They say that the effect of the tax would be to add respectability to the bucket-shop business, and that Congress might with the same propriety legitimatize faro, keno, or any other well-known form of gambling. To this the Senate Committee's practical reply is that this tax ought to be levied as a police regulation, if for no other reason. The Finance Committee in making its report favoring the bucket-shop tax had directly in mind the supervision of that business by the officers of the Internal Revenue Department. It is better, the Committee thinks, to regulate the business as proposed, with a prospect that the regulation will remove many of its objectionable features, than to permit it to run as heretofore, subject to no regulation except that provided in the Penal Code.

AN ELECTRIC BRIDGE.—A special dispatch from Duluth, Minn., says: "Bids have been advertised for and the contract will probably be let in two or three weeks for a bridge to cross the ship canal at the entrance of Duluth harbor. The conditions are peculiar. About 100 large ships pass through the canal daily, besides innumerable tugs, etc. A swing-bridge would not be permitted by the Government, and the Lake Carriers' Association would bring pressure to bear against any kind that would hinder navigation. So the bridge is to be aerial, but is to carry a traveling car that will cross the 300-ft. canal at street level every few minutes. This car will be swung from a truss 150 ft. high, far enough up to clear the masts of the tallest ships. On the truss will be a carriage running on a track, and suspended from this carriage by wire ropes will be the bridge at the level of the adjoining streets. The carriage will be operated by electricity, and will cross very quickly. The car will be covered and comfortable. The design is the invention of a French engineer, and a bridge similar in general plan is in use in Rouen. It will cost about $100,000, and while it will be erected and owned by private capital, the city is to reserve the right to buy, and will, from the first, operate it as a part of the municipal street system.

SPLIT-PHASE MOTOR PATENTS.—In addition to the decision noted in these columns last week enjoining a fan motor company from infringing a claim of Tesla patent No. 401,520, the same court has rendered a decision against the same company enjoining it from infringing claims in two other Tesla patents. These latter patents were both issued Dec. 26, 1893, on applications filed Dec. 8, 1888, and both relate to the split-phase method of starting single-phase motors. One of the patents, No. 511,550, is on the method of operating motors having independent field circuits which consists in sending an alternating current from a single source through both circuits and varying or modifying the relative resistance or self-induction of the circuits, thereby producing a difference of phase. The claims of the second patent relate to means for carrying out the above method patent. One of the contentions of the defense was that the inventions of the patents in suit are covered by a prior patent issued to the same inventor, namely, patent No. 416,193, issued Dec. 3, 1889, on an application filed May 20, of the same year. The claims of this patent, the court decides, are only on a specific form of construction and not on the method or process by which all the motors of its class are operated. Moreover, the applications for the three patents were pending at the same time, and under these circumstances priority of date can have no prejudicial significance among the three patents, and the defense of double patenting, therefore, cannot stand.

STANDARDIZATION BILL.—The bill before Congress to establish a National Standardization Bureau has been made a special order in the House, but has not yet been reported from the Senate Committee on Commerce, owing to the Subsidy Bill having seriously interfered with its work. We learn that an endeavor will be made to pass the measure as an amendment to the Sundry Civil Bill.

AMERICAN ELECTRIC AUTOMOBILES.—Mr. J. S. Critchley, manager of the automobile department of the British Electric Traction Company, Limited, of London, has been in this country for the last three weeks, investigating various things connected with the development of self-propelled vehicles. "Except for your electric vehicles," he said before leaving for England last week, "New York seems to me to be about two years behind London in the use of automobiles. Your roads and streets are not so well adapted to their use as ours, of course, but besides that, you have not yet achieved the same excellence in model or construction. Your smaller electric vehicles are in advance of anything I have seen elsewhere, and I think some of your developments along that line will soon be imported by us."

TO PREVENT DAMAGE BY ELECTROLYSIS.—A bill has been introduced in the Indiana Legislature to prevent injury to water and gas pipes by electrolysis. The measure is prolific in drastic provisions, and is aimed principally at the Indianapolis Street Railway Company, although its general application includes all electric companies. The bill provides that all electric street railway companies operating in a city shall use the "double trolley system," or "some other equally good insulated metallic-circuit system." It also provides that after six months from the time the bill becomes a law all companies furnishing electric current, heat, light or power for any purpose shall comply with the provisions of the act and submit to the Board of Public Works a copy of the changes to be made. All ground circuits are to be unlawful, unless thorough insulation is observed. A penalty of $25 a day for non-compliance with the provisions of the law, and the company's charter and rights and privileges in the city are to be forfeited if the company offending does not carry out the provisions of the law. The measure has aroused the representatives of electric companies of all kinds.

TELEPHONE INVENTION CONTROVERSY.—In noting the letter to this journal, written just before his death by Dr. Elisha Gray, claiming again priority of invention as to the telephone and asserting that he was cheated out of his rights by the rascality of Wilbur, Mr. George C. Maynard, who is the Washington correspondent of the *Electrical Review*, and whose statements were attacked by Dr. Gray, quotes the well-known earlier letters of 1877, in which Gray addressed Prof. Bell in terms that fully conceded the latter's priority. Mr. Maynard also cites Wilbur's notoriously bad character and vicious habits, as fatally affecting the value of any kind of statement he might make. In addition to this, when the Gray letter was shown him, "Prof. Bell simply said that the records show plainly that the statement is not true; that his invention and application were completed long before the papers were filed in the Patent Office, and that he received no information or suggestions of value from Gray." We do not see how Prof. Bell could be expected to say anything else. The record is there. The point of interest was the revelation that Dr. Gray died apparently more convinced than ever that he was a deeply wronged man in regard to one of the greatest inventions of this or any age.

MAGNETIC SEPARATOR.—A Canadian correspondent writes that the Wetherill magnetic separator is attracting a good deal of attention in mining circles. The feature of this machine is the great power of its magnets, and the concentration of the magnetic field. One of the best machines of this type in existence forms part of the equipment of the mining department of McGill University, Montreal. In this machine, the two magnets have 40,000 ampere-turns, and by the peculiar shape of the pole-pieces all the magnetic field is concentrated into a space less than the area of a leadpencil. The powdered ore is carried on a belt under the poles of these fields. Just over the belt and under the magnet pole is a second belt, running crosswise. When the ore passes under the magnet the magnetic particles rise and are held by the magnetism to the under side of the upper belt. This belt carries them out of the field of the magnet, and they then drop into an appropriate receptacle. Meanwhile, the residual ore again goes through the same treatment to insure a thorough separation, and is dumped into another receiver.

LETTER TO THE EDITORS.

Pupin's Long Distance Telephony System.

To the Editors of Electrical World and Engineer:

Sirs:—I have looked in vain through recent issues of your journal for information concerning the ocean telephone of Prof. Pupin, which, according to newspaper accounts, renders ocean telephony possible. Have you printed anything on this subject?

PITTSBURG, PA. C. N. MANNING.

[We are not aware that Dr. Pupin has invented an "ocean telephone." As we have received several similar requests for information, we reprint below an editorial from our issue of May 26, 1900, commenting on Dr. Pupin's paper on "Telephony Over Cable and Long-Distance Air Lines," read before the Philadelphia meeting of the American Institute of Electrical Engineers; and an analysis from our issue of June 30, 1900, of the two patents issued June 19, 1900, to Dr. Pupin on his system. These two articles summarize quite fully the principal features of Dr. Pupin's work.—EDS.]

The most important, and from several points of view, the most interesting paper presented at the Philadelphia meeting of the American Institute of Electrical Engineers, was that of Prof. Pupin on "Telephony Over Cable and Long-Distance Air Lines." The plan of the paper is most admirable, and may well be taken as a model for future papers dealing with complicated subjects. In the development of the subject, the physical conceptions are first given and illustrated by mechanical analogies. The deductions from the theoretical portion of the paper—which is wisely made to form a separate section—are then introduced and explained with reference to the phenomena involved. Next, the results of complete experimental tests of the principles established are given. These latter are so conclusive that the final or mathematical portion of the paper might have been omitted, though as a beautiful specimen of analysis its presence will be pardoned even by those who look askance at higher mathematics. The practical value of Dr. Pupin's paper lies in its theoretical and experimental demonstration that at little expense and with simple means a practical equivalent of Heaviside's distortionless conductor is possible. That is, by a proper disposition of inductance along a line, the attenuation and distortion of telephonic currents may be reduced to a minimum. It has, of course, been long known that the distortional effect of a telephone line could be controlled by maintaining certain relations between the capacity, inductance and resistance of the line. These relations, however, have been stated in terms of distributed inductance; or, at least, it has not been shown that a distortionless or uniform conductor could be approximated to within a definite limit by an equally definite distribution of inductance coils along a line. It is true that experiments have been made to test the efficacy of the introduction of such coils in a line, but lacking a theoretical guide, failure has been the result. Prof. Pupin points out very clearly the reason for such failure, for if the inductance introduced has not its proper value and is not distributed in a perfectly definite relation, the phenomenon of reflection occurs. That is to say, the inductance itself becomes a source of secondary waves which react on the line, thus increasing rather than decreasing its effectiveness. Dr. Pupin, basing his mathematical analysis upon the theory of wave propagation, establishes a simple law which determines the degree of equivalence between a non-uniform conductor—or a line in which inductances are inserted at intervals—and a uniform conductor; and by means of the formulas deduced, the value and distribution of the inductances along a line for an allowable attenuation that may be exactly calculated. The interest of the paper would have been much enhanced had the commercial bearing of the law deduced been set forth by definite statements as to the effect of its application on the design of long-distance telephone lines—that is, the probability of substituting ordinary telegraph wire for the present expensive copper conductors of large sectional area. This probability would appear to be a deduction from the principles established, for the attenuation factor shows that an increase of inductance will compensate for an increase of resistance; and the law indicates how the increased inductance may be inserted into the line in a manner not to introduce ill effects of itself.

Two patents were issued to Prof. M. I. Pupin, June 19, relating to the method of improvement of telephonic transmission which formed

the subject of a recent paper read before the American Institute of Electrical Engineers.

In one patent the claims are on a method of diminishing the attenuation constant of a uniform wave conductor, which consists in sufficiently increasing the inductance of the conductor by distributing along it inductances at periodically recurring points; the distance between consecutive points being such as to preserve approximately the character of the line as a uniform conductor with respect to the waves to be transmitted. As will be seen, the above is a method patent, and the second patent relates to details for putting it into effect. One claim specifies that the distance between the interposed coils shall be adjusted in such a way as to equal a fractional part of one-half of the shortest wave length which is to be transmitted; another claim specifies that the distance between the interposed coils shall be adjusted in such a way as to be equal to the fractional part of one-half of the wave length corresponding to the highest frequency essential to the transmission of speech. Two other claims specify that the distance between consecutive inductance coils shall be equal to or less than one-sixteenth of the smallest wave length which is to be transmitted, or to one-sixteenth of the electrical wave length corresponding to any frequency which is essential to the transmission of speech.

The method is illustrated with reference to two particular cases. One of these is for a telephone line 3000 miles long, consisting of a copper wire of 4 ohms per mile resistance (No. 9 B. & S.); the capacity per mile of such wire hung as are the long distance air lines of the American Bell is .01 microfarad. To secure a sufficiently high degree of approximation to a uniform telephone line, one coil per mile is required, the inductance of which should be .2 henry and the resistance .6 ohm. Such a coil, using no iron, would take about 1600 ft. of wire, of 2 ohms per mile (No. 6 B. & S.), wound into a coil of 5 inches internal diameter and 12 inches in length. This line would be of comparatively high inductance, and transmitter coils of a larger transformation ratio than those employed at present will be found more suitable for working over such a line.

The other case is that of a submarine cable 2000 miles long. According to present cable construction, the capacity per mile would be .3 microfarad, and it would be necessary to introduce 8 coils per mile, having an aggregate inductance of .3 henry, and a resistance of 1 ohm per mile, thus increasing the cable resistance to 6 ohms per mile. Employing cores of iron or steel, it is stated that coils of this inductance can be readily made which will be small enough to go within the sheathing of a submarine cable, as these are constructed to-day, and at the same time show negligibly small Foucault-current and hysteresis losses. The construction of a coil is described in detail, it having a diameter when finished less than 2.5 inches and a length of 4.25 inches. It is added that unless induction coils with iron cores are constructed in such a way as to keep down the magnetization, hysteresis, Foucault losses and distortion of the current by the varying value of the magnetic permeability of each cycle of magnetization, they will work disastrously.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

REFERENCES.

Direct-Current Dynamo Curves and Parallel Operation.—ADAMS.—An article pointing out the relation between the external characteristics of dynamos and the facility with which they may be operated in parallel.—*Am. Elec.*, Feb.

A Sparking Dynamo for Gas-Engine Service.—A complete description, with working drawings, of a small bipolar dynamo of the Manchester type for gas engine ignition. Two windings are given, one for 14 volts and 3 amperes, and the other for 32 volts and 1¼ amperes.—*Am. Elec.*, Feb.

Fan Motors.—HENSHAW.—A very long illustrated article on the history and development of the electric fan motor. Also an article by Riggs on electric fans in the export trade.—*Elec. Rev.*, Feb. 9

POWER

Electric Power in Iron and Steel Works.—WALKER.—A long illustrated article in which the different electric and magnetic methods used in iron and steel works are discussed. He deals with magnetic separations and the use of electric motors for cranes and other power purposes. He thinks that electric motors should be employed with success in the rail and plate mills; but motors of sufficient size should be chosen and actual tests upon existing plants should be made. He also deals briefly with the electromagnetic brake, the electric furnace, the lighting of the plant and the wiring. He recommends using cables covered with a thick coating of vulcanized rubber, overlaid with some substance, such as yarn, that will protect it from the action of moisture and the friction of the metallic masses that it is practically impossible to keep it free from; but the wrapping should also be of considerable thickness, and the cables should be overhauled periodically, and any damaged places repaired. The article concludes with some favorable remarks on the polyphase system, as compared with the direct-current system, especially on account of the advantages of the induction motor.—*Eng. Mag.*, Feb.

Gas Power for Central Stations.—An editorial referring to a recent paper of Humphrey, in which he said the limitation of gas-driven electric power stations in stations of small size has arisen from two causes—the non-esistence of a gas generator capable of producing power gas on a large scale at a cheap rate, and the low power of the largest available gas engine units. These obstacles he considers to have been removed respectively by the Mond gas producer, and by the practicability of building gas engines of several hundred, or even 1000 to 1500-hp rating, which will work as economically and satisfactorily as the best of the smaller sizes. The prospects of the gas engine are said to be very bright, and the days of the steam engine are claimed to be over.—Lond. *Elec.*, Feb. 1.

REFERENCES.

Electric Driving of Looms.—An illustrated description of the gearing used with an induction motor. In order to change the speed to suit the work in hand, the motor pulley is altered when driving by belt, while if toothed gearing is used the pinion is changed, the distance between centers being suitably adjusted by a simple eccentric device.—*Genie Civil,* Sept. 29; abstracted in *Science Abstracts,* Jan.

Induction Motors in a Tobacco Factory.—BAUSCH.—An illustrated description of a three-phase power plant in the Wetmore Tobacco Factory at St. Louis, Mo. The plant is of a conventional character, the motors being in some cases belted to single machines, and in others belted to line shafts driving a group of machines.—*Am. Elec.*, Feb.

Water-Power Plant.—FITCH.—A well illustrated description of the water-power plant for transmitting electric power from the Apple River to St. Paul, Minn. There are four 800-volt, 60-cycle, 750-kw three-phase alternators, running at a speed of 300 r. p. m. For transmission the voltage is raised to 25,000. The length of the line is 27 miles, the voltage drop 7.7 per cent.—*Cassier's Mag.*, Feb.

TRACTION.

Electric Locomotives and Multiple Driving.—TYLER.—A paper in which he compares the use of electric locomotives and of multiple driving for electric traction on main lines. He points out that the feature of railways, as distinct from tramways, is that each company is merged in one vast network of lines over which neighboring companies run their rolling stock, without regard to the limits of their own systems. It follows that, pending the universal adoption of electric traction, the service will be a mixed one, and it will be necessary to handle the ordinary rolling stock of any company possessing running powers. The only means of applying electric traction to this influx of through trains is by electric locomotives. The conclusions of the paper are as follows: "Where the total effort required is not more than can be exerted by a 50-ton locomotive, equipped to haul up to its full limit of adhesion, and where the question of control from either end without shunting is not an es-

sential, the separately driven axle system does not offer any advantages commensurable with its greatly increased complication. Where the power required is in excess of the above, the alternative lies between multiple-driven axles and coupled locomotives. The general question of convenience would even here seem to pronounce in favor of the coupled locomotive. There is an undoubted advantage in having the equipments separate from the coaches, so that a defective locomotive may be replaced without breaking up a train. If, however, the trains must be controllable from either end, then some kind of multiple-driven axle arrangement is necessary, although if the traffic is frequent enough to make shunting impossible, it should be worth while to end the line in a loop connecting the up and down rails."—Lond. *Eng'ing;* abstracted in *Eng. Mag.*, Feb.

Polyphase Traction.—An illustrated article on the Secco-Colico-Sondrio-Chiavenna railway in Italy, which has a length of 106 kilometers and will start running in the course of the coming spring. As already noticed in the Digest, a voltage of 20,000 is used for transmission and reduced to 3000, at which pressure it is conducted directly to the induction motors on the vehicles by means of the working conductors. In order to test the new system, Ganz & Co. built a trial line in 1899 near Buda Pest, where they have running a motor car provided with two motors, each of 150 hp, which are directly fed with current at 3000 volts. This trial line has worked to great satisfaction. Several illustrations show the truck of the motor cars to be used on the Italian railway, and also the trial line. —*Lightning*, Jan. 31.

Storage Battery Cars.—A description of the Bologna & San Felice Railway, which is 42 miles long, and serves a purely agricultural district, so that the traffic is anything but heavy. The cars are equipped with two motors and batteries of Pescetto cells. Charging is done at Bologna by conversion of the three-phase current from a power distribution company there, and for this purpose synchronous motor-generators are used. The working pressure is 500 volts, and the battery capacity is 300 ampere-hours. On this basis, trains are run at three-hour intervals. The comment is that the introduction of lighter types of battery like the Pescetto and others seem to have altered the conditions which formerly made accumulator traction impracticable.—*L'Elettricita;* abstracted in *Lightning*, Jan. 31. Another description of these cars in *St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

Acceleration of Electric Cars.—Morse.—A paper illustrated by diagrams. The first refers to the accepted theory that in train operation acceleration should be rapid and constant in such cases where the maximum speed is to be reached soon after the staritng in order to secure the best economy. He then proceeds to lay out acceleration curves for different conditions. The acceleration curves employed in best practice coincide very closely with a parabola. He shows a number of parabolas so drawn, which can be closely duplicated from actual curves. For very rapid rates of acceleration an ideal curve would consist of a straight line, the upper third of the curve being a parabola. He then assumes a train of 132 tons, starting against a grade ½ of 1 per cent, and designed to reach a maximum speed of 24 miles an hour in 30 seconds. The first thing is to draw a curve, which is made up of three curves, one being the force to overcome inertia, the other due to train resistance and the third due to grade. It is then possible to find the mile pounds per hour required to drive every ton weight of the train. This quantity expressed in watts and determined for each thirty-second is given in a curve. He gives curves from which the power required and the efficiency of the motors under different conditions of starting can be determined—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

How to Make Non-Paying Roads Pay.—Cooper.—The third article of his series. He discusses the question of fares, and divides the passengers into five classes. Great conservatism and caution should be exercised in reducing fares, as a slight reduction often means all the profit, and it is very difficult to restore the old fares after a reduction. Partial reductions can be made by selling a number of tickets for less than the regular fare. The following concessions can often be made to advantage: To a particular class of persons or travel; to certain fixed hours or days; between certain fixed points; a combination of any or all of the above. The chief rule to observe is, do not issue more concessions than are absolutely necessary, and reserve some concessions for future use.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

Current Supply to Long Railways.—Sieber.—A communication in which he makes some critical remarks on the paper of Rasch (Digest, Jan. 26). The three-wire system in the form suggested by Henry (Digest, Sept. 15), is recommended. He claims that the numerical values upon which Rasch bases his calculations, differ greatly from those in actual practice, so that his conclusions also cannot be regarded as strictly correct.—*Elek. Zeit.*, Jan. 17.

Telpherage.—An illustrated description of the automatic aerial electric car, of the Consolidated Telpherage Company's system in daily use at the works of the Crocker-Wheeler Company for carrying castings from the brass foundry to the machine shop. Two grooved wheels resting upon the carrying cable are directly connected each to two small electric motors. A trolley carried upon a short pole upon the upper side of the carriage takes current from the trolley wire suspended about 15 in. above the carrying cable, which forms the return.—*Eng. News*, Feb. 7.

Street Railway Association Meeting.—An account of the proceedings at the recent annual meeting of the Ass. of St. R'y Managers of the Rhine region and Westphalia. Director Geyl, of Frankfurt, referred to the advantages of uniformity of equipment, in which he was a thorough believer. The next subject discussed was that of electric heating. Lange thought electric heating very expensive, but recommended the use of the motor rheostats as heaters. Hippe quoted the somewhat peculiar fact that the cars equipped with motor-driven air brakes took less current than those equipped with hand brakes. This is due to the fact that the motorman having greater confidence in the certainty of the airbrake operation, applies the brakes less frequently than he would a hand brake. He also quoted figures as to power consumption in different cities. Another question discussed was the greatest permissible grade for electric motor cars using trailers. One road is mentioned with a grade of 1 in 14, where a trailer is used between two motor cars. On other roads, where the grades are 1 in 15, trailers without brakes are used. "At Lausanne, Switzerland, there is a road with several 12 per cent grades, 100 m. in length, on which a special safety brake is employed, which acts upon a wooden block buried in the pavement next to the rail."—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

Foreign Tramway Situation.—An interview with W. J. Clark, general manager of the Foreign Department of the General Electric Company, with headquarters in London. There are no important interurban lines existing to-day in Great Britain, although there are some on the Continent. One proposed in South Lancashire, England, however, when completed will be very important. The great difficulty in Great Britain has been that, as the interurban lines are necessarily under private control, and as most of the city lines are owned by the municipalities, the former have difficulty in making arrangements to secure terminal routes. Sentiment in England is now favorable toward electric railway construction. The practice in Great Britain of using small generating units is also disappearing. He then criticizes the use of alternating-current motors for traction work, and says that American manufacturers have had far more experience with alternating-current work than Continental manufacturers, but decline to recommend them. His own company has had a car at its works operating with alternating-current motors for seven years. Germany has so far been the leader in Europe in electric traction, but the entire investment in all the tramways and light railways of Europe is only about one-third that in the electric railroads of the United States.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

Denver Tramway.—A long, well illustrated description. The company operates about 430 cars. The method of dispatching cars by telephone is first described. There is a main dispatcher at the downtown office, to whom all the conductors report as soon as they reach the end of each trip. In case of delay the dispatcher knows exactly where every car is, and can alter the runs if he desires. The construction of the rails and the cars is described and illustrated. The cost of power generation was 1.1 cents per kilowatt-hour during October, 1900. A description is then given of the company's repair shop. Compressed air is used largely for blowing out copper dust from the motor cases. The motors are removed from the cars regularly every one or three months, and all parts are carefully gone over. A part which is found to wear considerably is the armature shaft. As the armature bearings have to fit the armature shaft, the company keeps four sets of bearings on hand, each 1-32 in. smaller than the one next larger. When a shaft is worn so that it is too small for the larger bearing, it is turned down so as to fit the next sized bearing. When it is too small for this bearing it is reduced to the next smaller, and so on. In this way a close enough fit for practical purposes is obtained, while the bearings are made in quantities and

kept in stock instead of being made separately for each motor, as required.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

Ohio River Electric Railway & Power Company.—This new road has recently been opened and connects several adjoining towns on the Ohio River. Its length is about 12 miles. Overhead trolley construction is used, and the road is constructed under steam railway specifications. It is expected that many freight cars will be hauled, an electric locomotive being provided and the tracks of the electric road connecting with the terminal of the steam road. The power is obtained from a steam plant near the center of the road. The rolling stock consists at present, beside the locomotive, of six 10-bench open cars, two standard closed cars and two combination cars.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

New Cars for Fairhaven & Westville Railroad Company.—These cars are intended for running at a very high speed, and their details have been carefully worked out. The vestibules are completely enclosed. The trolley board extends the entire length of the car, and is supported on rubber washers to prevent the transmission of vibration. Two trolley poles are provided, and links near the base hold down the pole not in use.—*St. R'y Jour.*, Jan. 19, and Int. Ed., Feb.

Control of Car Heaters at St. Joseph, Mo.—The conductors are not allowed to regulate the electric heaters on the cars. All cars are run by the company's office, and during cold weather a sign is posted in the office, indicating the position at which conductors must keep their heater switches. In case of a shortage of power, the company thus has control over the use of the current in the heaters.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

Pekin-Machiapu Electric Railway.—The steam railroad between Tientsin and Pekin is obliged to terminate at a distance of about two miles from Pekin, on account of the prejudice of the natives. This distance is now covered by an overhead trolley line. The power station, which contains the waiting room for the road, is situated a short distance from the railroad station, and contains two 45-kw dynamos run by 75-hp engines.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

REFERENCES.

Control of Tramway Motors.—SIEBER.—An article illustrated with many diagrams. He classifies the different types of motors and their control into several classes. He calls attention to a disadvantage which is common to shunt motors, motors excited by means of current from an independent source, as a battery, motors with the Sprague system in double-motor cars, and motors with compensating conductors between armature and exciting coils in cars with 10 or more motors. The common disadvantage is that, if in a car equipped with two motors, the speed or the field of one motor varies only a very little relative to the second motor, a considerable variation of the load of the motor at once occurs. The control of the different systems is shown in diagram. The article is concluded by a detailed enumeration of the different advantages and disadvantages of each system.—*Elek. Zeit.*, Jan. 10; translated in Lond. *Elec. Eng.*, Jan. 25.

Sleet Cutters.—WEEKS.—A description of a sleet cutter used by the author, which is said to give superior results to the ordinary sleet-cutting wheel. The form advocated is a scraper with bifurcated wings, which straddle the trolley wire.—*Am. Elec.*, Feb.

Electric Traction in Great Britain.—A map, accompanied by an editorial note, showing the distribution of electric tramways and railways in the United Kingdom. The trolley system is prevalent, but the third-rail systems are also growing in number—23 lines are municipal, the remaining 40 are owned and worked by companies.—Lond. *Elec.*, Feb. 1.

Spokane.—An illustrated description of the street railway of this city which has about 40,000 population. The company operates 25 cars in winter and 40 in summer.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

New Power Houses in St. Louis.—The principal street railways in St. Louis have recently been consolidated, and the consolidated companies will install two new power stations, from one of which current will be distributed at 6000 volts. There will be two 1200-kw, three-phase generators. The other station will contain four 2250-kw, three 1500-kw and three 600-kw direct-current generators.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

School for Motormen.—A long article on the school for motormen, conducted by the Metropolitan St. R'y Company, of New York.—*St. R'y Jour.*, Feb. 2, and Int. Ed., Feb.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Northwich.—An illustrated description of the electric plants of Northwich. It was first intended to utilize water-power, but it was found that if Mond gas was used, obtained from neighboring chemical works, both the capital outlay and the running expenses would be lower. A gas holder is used of 2000 cubic ft. capacity; it is intended, not for storage, but to minimize the effect of the intermittent demands of the engines upon the regular flow of gas in the mains. There are three 60-kw current generators, giving 125 amperes at 480 volts; there are also two 7-kw boosters, giving 100 amperes at 70 volts. A battery of 256 chloride cells, with a capacity of 200 ampere-hours, takes the whole of the night-load after 12 p. m., and most of the forenoon. The battery is generally connected with the outers of the three wire systems, and a balance is provided to equalize the loads. At Northwich there are 9000 lamps of 8 cp, and a number of motors for hoists, and for turning the swing bridges across the Weaver River. The latter installation is described in detail, and is said to be highly successful.—Lond. *Elec. Rev.*, Feb. 1.

Wigan.—A very long and well illustrated description of this British lighting plant. There are four steam-driven dynamos, two larger ones, giving 420 amperes at 400 to 500 volts on lighting load and 300 amperes at 500 to 550 volts on traction load. The two smaller ones give 300 amperes at 460 to 500 volts on lighting load and 215 amperes at 500 to 550 volts on traction load. There is also a battery of 280 cells, giving 75 amperes for 10 hours or 300 amperes for one hour. The charging is done as follows: The battery is put across the bus-bars, and the number of cells reduced until charging takes place. The cells so cut out of circuit are charged independently by a small motor-driven dynamo.—Lond. *Elec. Eng.*, Feb. 1.

Electric Installation in a Store.—An illustrated description of the electric installation in a new store in Chicago, owned by a large firm doing mail-order business. The three-wire direct-current system is used. There are four 115-volt, 100-kw generators. There are 5000 incandescent lamps of 16 cp and 40 enclosed arc lamps of 110 volts. Considerable power is also used, the total amounting to 170 hp, nearly all the motors being connected to the 220-volt circuits.—*West. Elec.*, Feb. 9.

REFERENCES.

Heating of Resistances in Discontinuous Service.—BETHKE.—A communication referring to the paper of Oelschlaeger, abstracted in the Digest, Feb. 16. He first considers the case in which the heating of the resistance is entirely due to the Joulean effect. With given dimensions of the coils, formulas for the heating of the coils can be easily deduced by considering the current density. His deductions are too mathematical to be abstracted. The formulas, however, seem to be practical. He also gives analogous formulas, if the heat produced in the iron in the neighborhood by hysteresis and eddy currents, is also to be considered. He has used such formulas for calculating the heating of railway motors which are also in discontinuous service.—*Elek. Zeit.*, Jan. 17.

Immersed Rheostats vs. Water Rheostats.—RUCKER.—An article describing two forms of immersed rheostat used by the author for testing purposes, and pointing out the disadvantages of the ordinary water rheostat and the superiority of the immersed type. A table is given showing safe capacities for iron wire in the ordinary exposed type and the immersed type of rheostat.—*Am. Elec.*, Feb.

Three-Phase System.—FYNN.—An article on "The development of three-phase working in the twentieth century." It gives a general review of the applications and advantages of the system, but does not seem to contain anything new.—Lond. *Elec. Rev.*, Feb. 1

WIRES, WIRING AND CONDUITS.

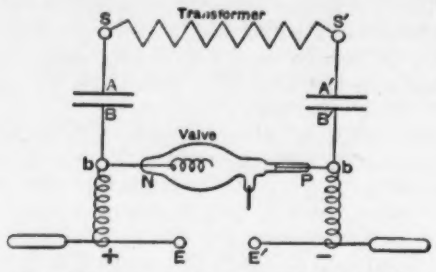
REFERENCE.

Transmission Lines.—EDMANDS.—An illustrated article on "Some power transmission difficulties on high-tension electric circuits." He briefly discusses the difficulties experienced with circuit breakers, lightning arresters and porcelain insulators in overhead lines, and refers briefly to trouble experienced in underground transmission lines.—*Cassier's Mag.*, Feb.

ELECTRO-PHYSICS AND MAGNETISM.

Transformer with Cathode Rectifier.—VILLARD.—An illustrated description of a new high-voltage transformer, in which one of the alternations is suppressed by means of a cathode-rays valve, which possesses at a certain exhaustion a resistance capable of opposing 60,000 volts in one direction, when the wire coil is the anode, and a

very feeble resistance to a current in the opposite direction. As shown in the adjoining diagram, the circuit is interrupted by condensers at *A B A*¹ *B*¹, as in Tesla's arrangement, and the valve is inserted between *b* and *b*¹. It contains a small rod of platinum in



TRANSFORMER WITH CATHODE RECTIFIER.

a side tube, which is heated to liberate the necessary amount of hydrogen. The same transformer may be made to feed two exciters.—*Jour. de Phys.*, Jan.; abstracted in Lond. *Elec.*, Feb. 1.

Luminosity of Gases.—STARK.—Luminosity is due to the impact of ions upon each other and upon central molecules, the luminosity being greater in the former than in the latter case. The greatest amount of luminous energy is evolved where the greatest number of encounters between positive and negative ions takes place, i. e., at the points of maximum ionization. The gas itself sends out the luminous rays, and the process is intimately connected with the diffused reflection of cathode rays by solid bodies. It is in the luminous portions of the discharge that the kinetic energy of ions produced at the cathode is absorbed. Luminosity is produced not only by the primary cathode rays, but also by the secondary ones, and indeed at a greater number of points by the latter, since, owing to their smaller velocity, they are diverted and dispersed to a greater extent by the positive ions.—*Phys. Zeit.*, Jan. 19; abstracted in Lond. *Elec.*, Feb. 1.

Lifting Electromagnets.—CLARK.—A description of some practical forms of magnets used by the Illinois Steel Company for handling sheet iron. Mr. Clark's experience indicates that the round form of iron-clad magnet, which has been so popular on paper, is not as good for lifting purposes as a multipolar magnet whose outline is substantially rectangular. A table is included in the article in which are given complete data for the designs of the magnets which are illustrated. The round magnet referred to lifted 19.4 lbs. per lb. of magnet structure, while a smaller bipolar magnet with slab-shaped cores lifted 26.7 lbs. per lb. of magnet.—*Am. Elec.*, Feb.

REFERENCES.

Alternating-Current Diagrams.—An explanation of the use of vectors to represent phase relations in alternating-current working.—*Am. Elec.*, Feb.

Induction Coil and Roentgen Ray Tube.—WALTER.—A paper on "The scientific use of the induction coil with the X-ray tube." He discusses the best design of an induction coil, especially if it is to be used with a Wehnelt interrupter. He recommends primary coils with variable self-induction.—*Fortschritte auf. d. Gebriet el Roentgenstrahlen*, v. 4, p. 1; translated in abstract in Lond. *Elec. Rev.*, Jan. 25.

Constancy of Permanent Magnets.—KLEMENCIC.—An account of observations extending over a year, regarding the constancy of permanent magnets of different makers.—*Akad. Wiss. Wien. Sitz. Ber.*, April 1900; abstracted in *Science Abstracts*, Jan.

ELECTRO-CHEMISTRY AND BATTERIES.

Lead-Zinc Battery.—A description of the Lecoll storage battery, which is a lead-zinc battery made in England. There are vertical lead tubes, each in the center of a strong cylindrical porous pot which is packed around the tube with lead peroxide. The other electrodes consist of sheets of fine gauze, of an alloy of copper, on which is deposited a coating of metallic zinc and cadmium. The sheet is passed around one of the outside cups and is then stitched together from top to bottom. The free ends are then passed around each half of the next cup, stitched again, and so on, so that each cup is wholly surrounded by gauze. The solution is said to be composed of metallic sulphates, those of zinc and cadmium predominating. The working voltage of this battery is between 2.5 and 1.8 volts, about 80 per cent of the normal discharge being above 2 volts. The ampere-hour efficiency is from 70 per cent, if discharged 20 hours after charging to 100 per cent if discharged at once. "Under the latter condition, indeed, the ampere-hour efficiency may rise to 120 per cent" (which throws a doubt on the other data). The watt-hour efficiency is, however, claimed to be only 95 per cent. The average output of these cells is about 10 watt-hours per pound of battery, equivalent to 3 hp for 4½ hours from 1000 lbs. of cells.—*Automotor Jour.; The Automobile*, Feb.

Formation of Storage Battery Plates.—CARRO CAO.—An account of experiments made to determine the variation of capacity and resistance of pasted plates during the period of their formation. The lead plates were immersed in dilute nitric acid, then washed, and made up in their cells with 10 per cent acid. After undergoing several charges and discharges they were pasted, and 46 charges an discharges made, the discharge being carried on until the e. m. f. had diminished 10 per cent below its initial discharge value. Both the capacity and resistance were found to increase regularly during the formation of the plates, but became constant after the fortieth charge and discharge.—*Elettricita*, Nov. 10; abstracted in *Science Abstracts*, Jan.

Electrolytic Bleaching.—An article on electrolytic bleaching with the "S-electrolyzer" of Schoop, for which high economy of working is claimed. The electrolyzer is said to be based upon three new principles. The solution of salt is electrolyzed in the form of thin columns of liquid; the surface of those platinum parts where chlorine is formed, is about 10 times greater than the surface of those platinum parts, where hydrogen is formed; the products formed at both electrodes are at once mixed by automatic circulation in the liquid.—*Schweiz. Blaetter. fuer Elek.*, Jan. 8.

Electromotive Activity of the Elementary Gases.—BOSE.—A study of gas batteries with special consideration of Grove's. His conclusions are as follows: The electromotive activity of the elementary gases is conditioned by their solubility in the metals forming the electrodes. The gases dissolved in the metal are to be considered as dissociated either wholly or partially into single atoms by reason of the high dissociating power of metals. The ions of an electromotively active substance are to be looked upon as formed in the electrode. The electrolytic solution pressure is measured by the product of the osmotic pressure of these previously formed ions by a factor, constant for each solvent, which may most simply be termed the electrolytic co-efficient of distribution. The general theory of gas batteries in which formation of the solvent occurs, may be developed on this basis. The saturation of the electrodes with the gases is a process of diffusion in the metal of the electrodes which proceeds with extraordinary slowness. The Grove gas battery works reversibly, "but its e. m. f. with the gases under atmospheric pressure is in any case higher than the received value." The acid and alkaline aqueous batteries differ in the place of formation of water, this being at the oxygen electrode in the acid element and at the hydrogen electrode in the alkaline. The second decomposition point corresponds to an irreversible process.—*Zeit. f. Phys. Chemie*, Sept. 18; abstracted in *Science Abstracts*, Jan.

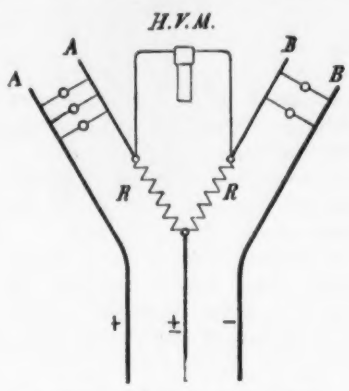
REFERENCE.

Zinc Processes.—BELLOC.—A description of three patents of Canova and Bertani, and one of Casaretti and Bertani, the first for the production of zinc white, and the three others for the production of metallic zinc in the electric furnace. The last process is worked by an electrometallurgical company. To produce 1 kgr. of zinc, 2 hp-hours are required, and the consumption of coal in the furnace is 15 kg. per 100 kg. of ore.—*Elettricita*, Sept. 22; abstracted in *Science Abstracts*, Jan.

UNITS. MEASUREMENTS AND INSTRUMENTS.

Units.—An abstract of a report of Guillaume to the recent Int. Congress of Physics in Paris. After some notes on the definition of the kilogram, the following unit of pressure is suggested: "The pressure of 75 c. m. of mercury, which, under normal conditions, is one of a megadyne to the square cm, is proposed for a practical unit of pressure, and the name barye is proposed for it." Reference is made to a resolution of the French Phys. Soc'y, to use "the term specific mass for the ratio of the mass of a body to its volume, and the word density for the ratio of the mass of a body to that of an equal volume of some other body taken as a type." It is thought that this resolution will not be agreeable to English physicists.—Lond. *Elec. Rev.*, Feb. 1.

Maximum Demand Indicator.—HOHMANN.—A long and detailed article on the principles of the Wright maximum demand system of charging; also a description of the maximum demand indicator. For use on three-wire circuits Dick has devised the arrangement shown in the adjoining diagram. In the neutral conductor two equal resistances, *R* and *R* are inserted, made of platinoid or a similar material with a small temperature co-efficient. The ordinary demand indicator, *H. V. M.*, is connected across the ends of these resistances. The indications are then proportional to the sum of the currents consumed in the systems, *A* and *B*. The indications are correct also when the loads in both systems are not balanced.—



MAXIMUM DEMAND INDICATOR.

REFERENCES.

Phase-Turning Apparatus.—CAMPBELL.—A reply to Duddell's criticism (Digest, Feb. 9). He explains the cause of the limitations of his apparatus and shows the apparatus can be safely used, not only to measure small voltages and "power lags," but also to indicate the occurrence of differences of wave form. Also a brief criticism by Marchant of Campbell's device.—Lond. *Elec.*, Jan. 25.

Galvanometer.—An illustrated article, in which the construction of a simple galvanometer is described.—*Tel. Mag.*, Feb.

Power Measurement in Alternating-Current Circuits.—CAMPBELL.—His illustrated Phys. Soc'y paper in full, an abstract of which was given in the Digest, Dec. 15.—Lond. *Elec.*, Jan. 25.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Insulated Telephone Wires.—WEST.—A communication on the use of insulated telephone wires, as suggested by Hackethal (Digest, Nov. 24). He agrees that these wires can be used to advantage for telephone wires, which are placed on the same poles with light and power circuits. Such telephone lines would be generally of shorter length. He believes, however, that the Hackethal system cannot be used in cities, nor in long-distance lines.—*Elek. Zeit.*, Jan. 3.

Method of Measuring the Vibration of a Transmitter Diaphragm.—MERRILL.—A short description of a method of computing the excursion of a diaphragm, which consists of mounting a small mirror parallel with the diaphragm, connecting the two by a light needle so that the mirror oscillates with the vibrations of the diaphragm, and reflecting a beam of light on a screen from the mirror. The travel of the beam of light bears a fixed relation to the excursion of the diaphragm.—*Am. Elec.*, Feb.

Wireless Telegraphy.—GUARINI.—A communication, in which he refers to some recent experiments made by him. The most interesting observation is said to be "that the transmitter and receiving coherer, about which there was nothing particular, were not connected with the earth nor with a capacity. One of the balls of the oscillator on the one hand, and one of the electrodes of the coherer on the other hand, were connected to the air wires, while the other ball of the oscillator and the other electrode of the coherer were completely free. This proves that electric waves are not propagated by the earth, but by the air, and that they do not follow the curvature of the earth."—Lond. *Elec.*, Feb. 1.

REFERENCES.

Hughes Telegraph.—GARLAND.—A brief illustrated note on a modification of the Hughes telegraph, consisting in a re-arrangement of the keyboard.—Lond. *Elec. Rev.*, Feb. 1.

Telephonograph.—RELLSTAB.—An illustrated article on the design and theory of Poulsen's instrument.—*Elek. Zeit.*, Jan. 17.

Small Telephone Switchboard Systems.—HENRY.—An explanation of two of the simpler forms of small telephone switchboards, with diagrams.—*Am. Elec.*, Feb.

Telephone Auto-Commutator.—An illustrated description of an "Auto-commutator," i. e., an apparatus for automatically making connections with a party wanted. The apparatus is being tried by the French Post Office, which is in charge of the telephone system of France.—*Sc. Amer.*, Feb. 9.

MISCELLANEOUS.

Electrical Fatalities.—KENNEDY.—A brief article calling attention to the fact that it is not the pressure upon which fatality depends, but the current, and that does not depend upon the pressure alone. "What is the amount in amperes of the fatal dose is not at present known, but it is probably much under one ampere." "It would be safer to affirm that all pressures over 200 volts can be dangerous to life, all over 500 volts certainly dangerous."—Lond. *Elec. Rev.*, Feb. 1.

REFERENCES.

Elihu Thomson.—A biographical sketch of Elihu Thomson, with a good portrait.—*Cassier's Mag.*, Feg.

Paris Exposition.—The fifteenth part of the illustrated serial, dealing with the crane of Flohr, a Gramme electrically-driven slotting machine and forge, and arc lighting machines of the Gramme Company and the Western Electric Company.—Lond. *Elec.*, Feb. 1.

KORDA.—An illustrated description of several three-phase alternators of French manufacture.—*Elek. Zeit.*, Jan. 10.

New Books.

RAPPORTS PRESENTÉS AN CONGRÈS INTERNATIONAL DE PHYSIQUE. Rassemblés et publiés par Ch. Ed. Guillaume et L. Poincaré, Secrétaires Généraux du Congrès. Trois tomes. Paris: Gauthier-Villars, 25 Quai des Grands Augustins. Tome I., 696 pages; tome II., 570 pages; tome III., 619 pages. Price, each volume 18 francs, or for the three volumes, 50 francs.

These three portly volumes contain the papers presented at the Paris International Physical Congress of 1900, and form undoubtedly the most important single contribution made in many years to the literature of the physical sciences. The list of authors contains 81 names, and is almost totally inclusive of the leaders in the theoretical departments of practically the whole range of physical science. The plan of the papers consists, in general, in giving the present status of the department of science treated, preceded by a rapid résumé of the various steps to date, and followed by a discussion as to future development. The work as published thus consists of a well-ordered résumé of the state of physical science at the beginning of a new century, and as such will long form an authoritative record to which advances may be referred, and with which to start the study of a given branch.

Tome I. contains the papers on general questions on metrology, mechanical physics and molecular physics. The first paper is a remarkable one by H. Poincaré, entitled "Relations Between Experimental and Mathematical Physics," but which is really a discussion of the methods of scientific thought and investigation of an order that places it in the same category with Descarte's Discours, Locke's Essay and Bacon's Novum Organum. Among the authors represented in this volume are Poincaré, Guillaume, Barus, Ames, Violle, Bjerknes, Voigt, Van't Hoff and Lippman. A section of papers in this volume of particular interest deals with the determination of the speed of sound, the mechanical equivalent of heat, the measurement of high temperatures, precision of measurements, etc.

The second volume is devoted to optics, electricity and magnetism, and contains 27 papers, among the authors being Kelvin, Lummer, Cornu, Poynting, Righi, Branly, Arrhenius, Blondlot, Warburg, Bouty and Nagaoko. The paper by Kelvin is on the hypothetical ether. Among the papers of a more general interest are those by Righi on hertzian waves; Branly on coherers, Arrhenius on electrolytic dissociation of solutions, L. Poincaré on the theory of the voltaic cell, Gouy on standards of e. m. f., Leduc on the electro-chemical equivalent of silver, Warburg on hysteresis, and Van't Hoff on some magnetic properties of cast and laminated iron. A paper by Poynting is on the mode of propagation of energy and electrical stress in the electromagnetic field.

Tome III. in the title page specifies as the subjects covered Electro-optics, ionization, applications of physics, cosmic and biologic physics, the third head covering several of the more practical papers read before the Congress. A paper by Lorentz treats of recent advances in electro-optics, and is followed by seven papers dealing with the new departments of physical science, opened up by the discovery of Röntgen, and the researches of J. J. Thomson and others in electrical discharges in gases—the authors being Drude, Becquerel,

Curie, Villard, J. J. Thomson, Villari and Bichat. These papers are almost indispensable to those who would inform themselves on the interesting and highly promising subjects of which they treat. Other papers are on the counter e. m. f. of the arc, by Lang; polyphase currents, by Potier; the direct inscription of variable currents, by Blondel; recent researches on atmospheric electricity, by Exner; the aurora borealis, by Paulsen; molecular phenomena produced by electricity on inorganic and living matter, by Bose; progress of heat engines, by Witz.

THE COST-KEEPER. Some Original Systems of Shop Cost-Keeping or Factory Accounting. By Horace Lucien Arnold. New York: The Engineering Magazine Press. 408 pages, illustrated.

The subject which this book covers is a rather difficult one to handle and make the contents applicable to the majority of cases, but the compilation of H. L. Arnold makes a start in the right direction, and its reading will convince the layman and shop keeper of the necessity of an up-to-date accounting of the details of his business. It is impossible to give, within the confines of some 400 odd pages, examples of each and every industry. The compiler has, however, chosen types from shops employing 50 men to those employing 300 and more, which are sufficient to answer general purposes.

The preface strikes the keynote—"Am I obtaining my true costs? Am I obtaining my costs in the best form? Am I exactly informed as to all separate expense items? Do I pay too much for cost-keeping, or shall I pay more and obtain my costs more in detail? Are there known cost-keeping systems so much better than mine that I should change my present methods?" We are led in turn to ask ourselves the questions—"Are our business affairs in tangible shape? Can we lay hold of any information in our possession without loss of time? Do we have to wait until an inventory to ascertain our gain or losses? Is our business being conducted on guess work or up-to-date principles?"

The first shop mentioned is that of a drop-forging plant employing about 100 men; the second, a roller bearing company employing about 50 men; the third, a cream separating establishment with 150 men; another, a general iron works, manufacturers of engines, boilers, tanks, pipes, etc.; and, lastly, a switch and signal manufactory. In each of the cases mentioned the card system is used; in some extensively; in others, enough to show the advantage of a still further increase.

The general tendency is to divide the departments into, for example, the office, factory, rough store, general stores, pattern and drafting and officers, as follows: General manager, having charge of the general business affairs and disposal of production, and responsible only to the directors of the company. The next in authority is the general factory manager, who bears the entire responsibility of production and is subordinate to the president only. His staff consists of a cost clerk and paymaster, a purchasing agent and a production order clerk, who originates production orders on the factory under requisition from the superintendent. The superintendent is in charge of the foremen. The drawing room is under control of the consulting engineer, who is under immediate direction of the superintendent. Then in turn follow the foremen, shipping clerk, general stores clerk and tool clerk.

Various types of card systems are illustrated, showing the use of cards, not only for production orders, shipments and general data, but also for book-keeping and a complete inventory of all stock, including memoranda of all the general details of business. The reports of the systems employed in the various industries mentioned are quite complete, having in most cases been exhaustively treated by the managing head of the individual establishments.

Factory organization and accounting is well taken care of by James Newton Gunn in a 50-page section under that heading. An article on the "Card System of Accounting," by R. A. Simonson, follows, and is a comprehensive general consideration of the economies and advantages arising from the use of cards instead of books. Among these advantages may be mentioned unlimited expansion, unity of item entry, collective value, collation of typical costs, cross reference, current summaries, perpetual inventory, department analysis, individual reference, self-indexing, transposition, saving of "overtime" money, no duplicate labor, numeric system, classification, mechanical features.

A short article entitled "The Expense Account" is an analysis of shop expense production, particularly with reference to the proper position under expense of duplicate or special machinery or apparatus, and the position in inventory of such items as patterns, etc. The final article is illustrative of the various aids to factory accounting, such as the time clock recorder, computing machines, such as slide rules for all problems in proportion, multiplying and dividing, and the various forms of comptometers for addition and subtraction, watchmen's clocks, book typewriters', etc.

BOOKS RECEIVED.

THE INSPECTOR AND TROUBLE MAN. By A. E. Dobbs. Reprinted from *The Telephone Magazine*. Chicago: Electrical Engineering Publishing Company. 106 pages, 67 illustrations. Price, $1.00.

MESURES ELECTRIQUES. Lecons Professées a L'Institut Electrotechnique Montefiore. By Eric Gerard. Second edition. Paris: Gauthier-Villars. 532 pages, 217 illustrations. Price, 12 francs.

LES PHENOMENES ELECTRIQUES ET LEURS APPLICATIONS. Etude Historique, Technique et Economique des Transformations de l'Energie Electrique. Par Henry Vivarez. Paris: Georges Carre et C. Naud. Octavo, 376 pages, 225 illustrations. Price, 15 francs.

Directory of Electrical Societies, Etc.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, New York, Oct. 17-20, 1901.

ASSOCIATION OF THE EDISON ILLUMINATING COMPANIES. Next meeting, Sept. 10, 1901.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Ottawa, Ont., 1901.

30-Drop Desk Switchboard.

The desk switchboard illustrated herewith, placed on the market by the Haines & Noyes Company, Chicago, Ill., is of the automatic self-restoring express type. The company recently acquired the patent rights on it, and it has been improved by their engineers. Its principal features, making it extremely simple and rapid may be enumerated as follows: It has a reliable night alarm; the drops are of the tubular type; all parts are readily removable for repairs; the drops are cut out of the talking circuit; the drops and jacks are

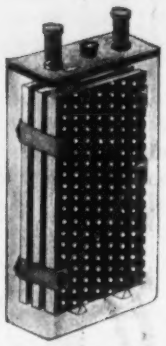
DESK SWITCHBOARD.

mounted independently, and can be taken out by simply removing the two thumbscrews at the back; the shutter is automatically restored from the front of the jack, and not from the rear, the restoration being done by the side pressure of the plug on the drop as it slips into place, thus doing away with complicated self-restoring mechanism; the clearing out drops are of the tubular type, bridged across the cord circuit, and the springs are of German silver, with scraping contacts.

The operator's equipment is for long-distance use. The switchboard cabinet work is of quartered oak, and the mechanical and electrical work throughout is said to be of the best quality.

The company manufactures a cheaper board than its "Express." It is similar to the latter, but the drops are not self-restoring.

Reuterdahl Accumulators.



ACCUMULATOR.

Announcements are now being made in regard to light, small and compact batteries, which the Reuterdahl Electric Company, of Providence, R. I., is putting on the market. The jars are sealed and being made of pressed glass, and are very neat in appearance. This company has made a departure from conventional types, and has dispensed with grids, depending upon a case of acid-proof material to retain the active material. This construction permits a large saving in weight and an increase of about 100 per cent, it is asserted, in capacity, size for size, or weight for weight. The cells are constructed durably, and the low prices, neatness and large capacity are expected to make large sales.

A New Common Battery Telephone.

There is being placed on the marked by the Couch & Seeley Company, of Boston, a telephone for common battery exchanges, which is claimed to embody some especially desirable features.

The back of the telephone is a hollow casting highly finished in black, handsomely striped, this being mounted on a half-inch oak backboard, as shown. The space between the backboard and the front plate of the casting is sufficient for mounting a condenser, which the company also manufactures. The ringer is attached as shown, and when the shelf is raised the ringer tips forward on hinges so that it is accessible for any adjustment or other attention which may be necessary. This also opens up the entire box in such a manner as to make it easy to reach the hook contacts, induction coil and all parts. This telephone is equipped with the company's regular long-distance coal grain microphone and bipolar receiver.

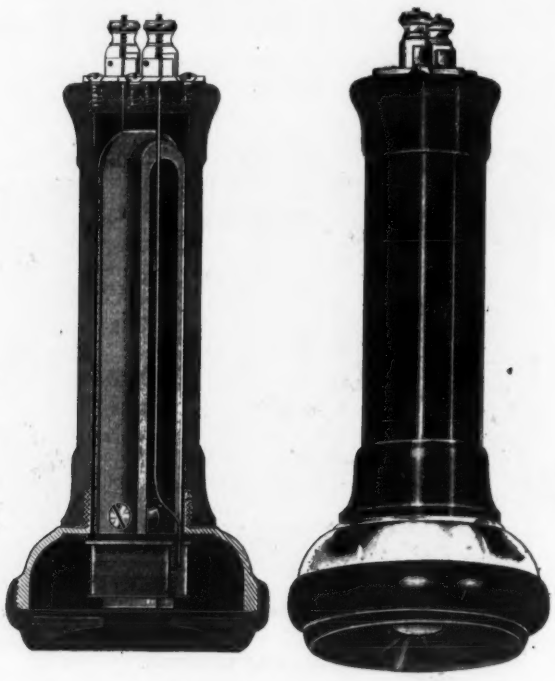
COMMON BATTERY TELEPHONE.

The company has been furnishing this common battery telephone to a limited number of exchanges for some time, but has not placed it on the open market heretofore, because it wished the instrument to be given a thoroughly practical test from every standpoint. It is now placing this instrument on the market as its standard type. Its various forms of desk sets are also made for common battery purposes, and for use on any of the various common battery systems employed.

A New Double-Pole Receiver.

The accompanying illustrations show the internal construction of a new double-pole receiver, and the instrument in perspective, manufactured by the Lambert Schmidt Telephone Manufacturing Company, of New York. The magnet is of special Wolfram steel, highly saturated and horseshoe shaped, with broad bobbins at the terminals. These bobbins have soft iron cores and are wound with silk insulated copper wire. At the intersection of the bobbins with the magnet is set a disk of brass for use in fastening the magnet to the outside shell. The receiver case consists of a heavy brass cup at the head, the handle being one piece of hard rubber covering the body of the magnet and threaded on the inner surface at the open end. This handle is screwed to the metal cup on a similar thread. The magnet itself is screwed into the brass cup by two machine screws extending through the brass disk before mentioned, these screws projecting into the rubber shell to prevent this shell from twisting. By this design, the metal cup and the magnet becomes one solid piece and the contraction, expansion or breakage of the rubber shell does not change the relative position of the magnet poles to the diaphragm.

The diaphragm is tin plated soft iron lying evenly on the metal cup. The receiver cap is hard rubber, shaped to clamp the diaphragm at exactly the same point with the edge of the metal case. The binding posts are peculiarly constructed. The body is an arch with a partially flat top. Inside this arch is a square block not filling the entire space, and with a long threaded pin extending through a hole at the top of the arch, but not screwed to it; on the contrary, this hole allows easy play. A finger nut is screwed to this pin and is in position directly over the arch. On the opposite sides of the arch are two small holes. There is also a similar hole through the metal block. The block is brought into position so that these three holes are in alignment and the cord tip is then pushed through. The finger nut is turned, thus drawing up the block and clamping the cord tip on each side of the arch so that it cannot possibly work loose. The binding posts have screw plates to prevent twisting. The finger nut cannot work off the threaded pin. Fixture wire is used from the binding posts to the bobbins. This receiver, it is claimed, requires no adjustment whatever, and for that reason never gets out of adjustment.



DOUBLE-POLE TELEPHONE RECEIVER.

Telephone Ringing Generators.

The two styles of generators shown in the accompanying cuts are among the latest productions of the Connecticut Telephone Company, Meriden, Conn. They are similar in general construction, the principal difference being in their size. They are substantially constructed, and are intended for use where a powerful and lasting machine is desired. The magnets are made of the best grade of magnet steel, and are bent and tempered in such a manner as to spring onto the pole pieces with a tight grip. In addition to this they are held rigidly in place by means of screws, and are so fitted between ridges on the pole pieces that they wil not shift by rough handling. The armature is laminated, the best of insulation being used in its assemblage. The company states that it gives a large output for its size. The bearings are extra long and closely fitted. The gears, which are heavy and made of a special grade of cast brass, are turned and cut on the shaft so as to make them run true, at the same time being adjustable.

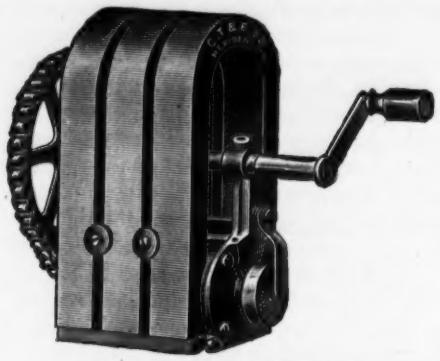


FIG. 1.—TYPE U GENERATOR.

The pole pieces are made of soft iron carefully bored out so that the armature will fit very close, thus reducing the air-gap to a minimum. These generators are designed for all the different styles of telephone apparatus, and are either mounted on blocks or in cases with the ringers and switchhooks.

The company is also furnishing an efficient power generator for short lines, and a double 8-magnet machine where an extra large output is desired. These generators are provided with either series automatic shunt or multiple automatic cut-in. The latter device, the company states, is a new departure. It is mounted directly on the end of the armature shaft, as shown in one of the illustrations. The company states that in some cases 35 to 40 of the 4-magnet type machines are in use on a single circuit, and are giving the best of satisfaction.

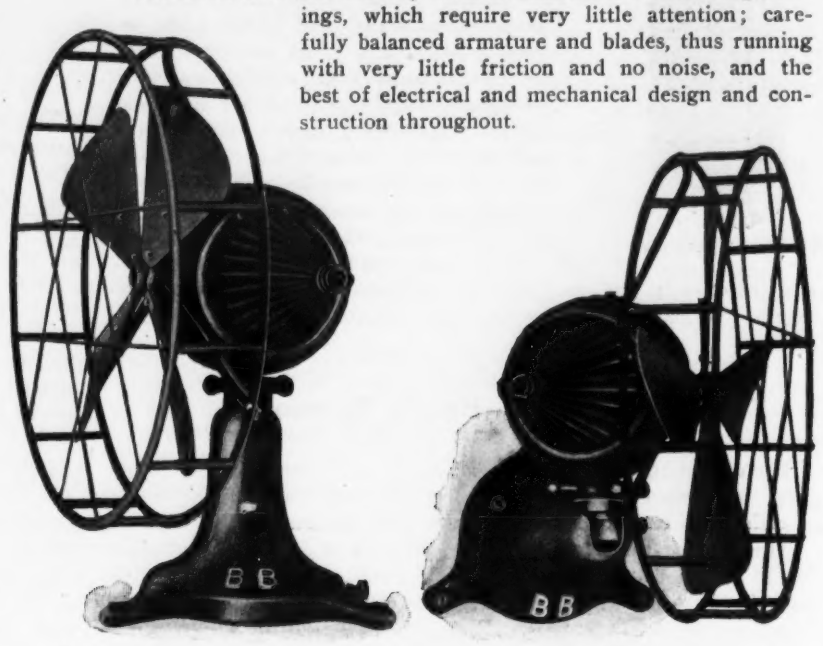
FIG. 2.—MULTIPLE MAGNETO.

B. B. Fan Motors.

The accompanying illustrations show the B. B. combination bracket and desk fan, which is manufactured by the B. B. Electric Company, 216 Greenwich Street, New York.

This motor is made with a ball joint, so that the fan and its mechanism can be set in a standard, for the desk, or in a bracket, and the joint is claimed by the manufacturer to be the only one with which the fan can be adjusted with one operation so as to throw air in any direction. All parts are made in jigs, and are therefore interchangeable, thus making it possible to order by mail any required part. Three speeds are obtainable by means of resistance, and a regulating switch in the base of the machine.

The features of this fan may be thus enumerated: Self-oiling bearings, which require very little attention; carefully balanced armature and blades, thus running with very little friction and no noise, and the best of electrical and mechanical design and construction throughout.

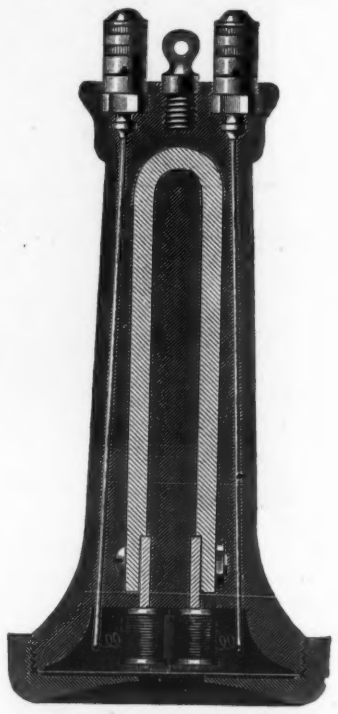


FIGS. 1 AND 2.—FAN MOTORS.

The standard fan is finished in black enamel, with solid brass guard and blades, but any other style of finish may be had on order. Each motor is thoroughly tested before leaving the maker's hands.

A "Solid" Telephone Receiver.

A new departure in telephone receivers is just being introduced by William J. Murdock & Co., of Chelsea, Mass., under the name "The Solid." The distinctive feature of this receiver lies in the fact that the magnet, the pole pieces, the binding posts, the wires connecting with the binding posts and extending through the case, and the supporting rings, are covered with the insulating material which forms the case and are solidly moulded therein, making the case and all these parts practically one piece. This gives the magnet a permanent position, and leaves the pole pieces always in the same relative position with respect to the diaphragm seat. The binding posts are made hexagonal in shape and grooved, this shape preventing all possibility of turning, and the grooves insuring them against pulling out when moulded into the case.



TELEPHONE RECEIVER.

The claims of the manufacturers are that the adjustment of their receivers being exact on the outset, this construction makes it permanently perfect, and gives a strength to the whole instrument that renders it capable of withstanding all sorts of hard knocks without injury; while the first cost is not in excess of that of familiar types of receivers, the cost of its maintenance is reduced to the minimum. The cut herewith shows a cross section of "The Solid," standard shaped receiver. Watch-case receivers are also made on this principle.

Electric Locomotive and Car Crane.

The electric locomotive illustrated herewith embodies the features of a flat car and crane car, and was designed by the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, to meet the convenience of manufacturers in handling their products in and about their works.

The side trusses of the car are made of cast iron of especial heavy construction to provide weight for tractive effect and as a counter balance for the crane. The center of gravity of the car is therefore low down and well distributed. The car body is 22 ft in length over all, and 9 ft. 6 in. wide, and the height from top of rail to top of crane is 13 ft. 6 in. The cab contains the controller from which the propelling motors are operated, a brake, a main switch from trolleys, and main line fuse block. Also controllers for the hoisting and swinging motors for the operation of the crane.

As a locomotive it is capable of handling eight loaded cars on a level track or two fully loaded cars on a 2 per cent grade. Power for it can be supplied from any direct-current circuit. The car is propelled by two motors, one upon each axle, and they may be wound for either 110, 250 or 500 volts. Double trolley wires are used to avoid the necessity of grounding one side of the line. The locomotive is provided with a jib crane having an extensible arm, so that the radius of operation may be varied. With a 10-ft. radius the crane will handle 10,000 lbs. The jib can be used at either side of the car, and the movement of the arm is controlled by the operator within the cab.

ELECTRIC LOCOMOTIVE AND CRANE CAR.

Cars set upon a track parallel to the one upon which the crane car stands may be loaded and unloaded. The capacity of the crane either in lifting power or radius of work within certain limits may be made to suit the requirements of manufacturers.

As a flat car there is available a space 14 ft. by 9 ft. 6 in. upon which may be loaded material for transfer from one part of the works to another. This feature of the car renders it a great convenience, and the entire load can be handled by the crane, the work of loading and unloading being quickly accomplished. The capacity of the car is 40,000 lbs.

A New Type of Gasolene Runabout.

It is a rather curious fact that one of the most improved forms of gasolene automobiles to be put on the market is due to the efforts of the Electric Vehicle Company, of Hartford, Conn. Mr. Hiram P. Maxim and other engineers of the company appear to have produced a machine of high excellence for work in the hydrocarbon branch of the art, and note of its remarkable "long distance" performance was made recently in these columns.

The automobile used in that 500-mile continuous test was a Columbia gasolene runabout, known as Mark VIII., having a total weight ready for duty of 1640 lbs. In this weight is included 11 gallons of gasolene, 1 gallon of lubricating oil, a fully-equipped toolbox with tools and spare parts, a complete equipment of headlights, a cyclometer, rear groom's seat and boot. The engine is a single-cylinder Otto cycle. The cylinder dimensions are 4.6 diameter by 6.8 stroke. The complete engine with 19-in. flywheel weighs 240 lbs. This weight includes governor, carburetter with piping, water cooling pump and necessary piping therefor. The power of the engine is 5-brake hp actual at 750 r. p. m. The engine is located in the front of the vehicle. Being of single cylinder and of low speed, the latter insuring long life and low repair expense, it is mounted upon a separate spring-supported frame of its own.

Power is transmitted from the engine flywheel through a friction clutch operated by a pedal in the floor. From the friction clutch a shaft runs longitudinally and carries four gears, three of them being for different gear reductions ahead and one for reverse. The countershaft to which they gear continues to the rear axle, which is "live," and which it drives through the medium of very large and generously proportioned bevel driving gears. The entire gearing is encased in one cast steel box, which includes the rear axle and which positively insures the alignment of everything. That this construction is carefully worked out may be judged by the fact that at 4-hp input at the friction clutch, the losses in transmission to the rear axle are only 6 per cent.

The gear reductions are, respectively, 15.2 to 1, 7.8 to 1 and 4 to 1, with 13.9 to 1 for reverse. These gears are thrown in by positive clutches, which are operated in a very simple manner by one lever projecting up at the side of the seat. While the principle of control is identical with that used on the best European vehicles, it is much simplified in this American arrangement. In the latest vehicles brought out by prominent European builders, it is to be noted that this getting of all the change gear functions into one lever is being done. In order to insure positively against attempting to throw in changes of gear without disconnecting the engine or source of power, a very simple and ingenious interlock is provided, which makes it impossible to change the gear without first pressing forward the

GASOLENE RUNABOUT.

clutch pedal which disengages the friction clutch on the engine flywheel.

The friction clutch is a plain windup brake faced with leather so that all degrees of slipping can take place without danger of cutting or running dry, ensuring wearing nothing more than a leather ban'. This, of course, is of ample proportions so as to prolong the life before the new leather has to be put in. The speed of the engine is controlled by a governor. This governor operates a valve in the suction pipe. In the suction pipe beyond the governor throttle is the aspirating carburetter, so arranged that when the governor throttle opens and permits a vigorous suction a larger amount of gasolene aspirates, or when the governor throttle by partially closing the suction pipe reduces the vigor of the engine suction, less gasolene is aspirated. This insures a uniform quantity of gas mixture at all engine speeds.

The engine is speeded beyond its normal by means of foot pedal control. The ignition is automatically advanced or retarded by the engine, according to its speed, so that the maximum effect is always produced from whatever charge the governor permits the engine to get. The ignition is by secondary current.

In the recent 500-mile run, when the climatic and road conditions were as severe as they are ever likely to be in this latitude, it was found that 14.4 miles were obtained per gallon of gasolene. the load being 2040 lbs., including the weight of two passengers, heavy wraps and baggage. The best average speed on this trip was 23 miles per hour, made on the west side of the Connecticut River. between Hartford, Conn., and Springfield, Mass., over roads that were a succession of grades.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—In the money market there was general quiet. The quotation for 30 to 90 day money is held at 3½ per cent, and 3½@4 per cent is the quotation for longer arrangements. Commercial paper was quoted at 3½@4 per cent for prime double names. Call money is quoted at 1¾@2½ per cent, the prevailing rate being 2 per cent. In the stock market conflicting influences were apparent. The railroad share list was quieter. Less attention was given to stories of further deals and combinations, but confidence was shown in the continued ability of railroads to pay their dividends, and the investment buying of securities was notably large. At the end of the week the activity relaxed somewhat. Expectations of a favorable outcome in the negotiations for a combination of the principal steel companies caused the stocks of those concerns to show decided firmness and a readiness to advance. Uncertainty as to the terms of the deal, however, checked the development of speculation in them. The sensational feature of the electric list was the sharp advance in General Electric common. On Thursday this stock registered a net gain for the day of 12½ points on transactions of between 5000 and 6000 shares. There is little floating stock on the market, which accounts for the advance in the face of such comparatively small transactions. The advance was the result of a report that the company had agreed to reinstate the stock in its old position, relative to the reduction in capital. There were also rumors about a stock dividend. The active interest in the stock was maintained and at the close the quotation was 211, representing a net gain over the close of the previous week of 14 points. The total sales were 14,499 shares; the range of prices was 197-217½. Western Union also revived from its long period of lethargy and the dealings were particularly active early in the week. The sales amounted to 112,340 shares, the highest price reached being 91, the closing quotation being 89, which is a net gain of 2 points. In the traction list there was little activity. Transactions in both Metropolitan and Brooklyn Rapid Transit were much smaller than those of the previous week. Metropolitan closed with a net gain of ⅞ of a point, at 163⅜, and Brooklyn Rapid Transit at a net loss of 1¼ points, the closing quotation being 77⅞. American District Telegraph made a net gain of 1 point on total sales of 200 shares, and American Telegraph & Cable made a like gain. The market for outside securities was devoid of any particular features, prices holding about steady. American Bridge was strong, as was Sheet Steel, the bullish sentiments on both stocks being predicated on the part the respective companies are supposed to play in the new steel combine. There was trading in 2000 shares of Bridge common between 45½ and 46½, while 200 shares of the preferred were dealt in at 94. American Sheet Steel sold to the extent of at least 1200 shares at 78½ and 78¾. Following are the closing prices at the four centres named:

NEW YORK.

	Feb. 9.	Feb. 16.		Feb. 9.	Feb. 16.
Gen. Electric	197	211	Elec. Veh.	16	15
Bklyn Rap. Tran.	78⅜	77⅛	Elec. Veh., pfd.	30	30
Met. St. Ry.	162½	163⅜	Gen. Car.	2⅜	2⅛
Am. Tel. & C.	96	97	Ill. Elec. Veh. Tran.	¾	¾
West. Un. Tel.	86½	89	Hud. Riv. Tel.	117	120
Am. Dist. Tel.	35	36	N. E. Elec. Veh. Tran.	3	3
Com. Cable	—	160	N. Y. Elec. Veh. Tran.	4¼	4½
Elec. Boat	27	27	Tel. & Tel. Co. of Am.	4	4
Elec. Boat, pfd.	51	52	N. Y. & N. J. Tel.	174	174

BOSTON.

	Feb. 9.	Feb. 16.		Feb. 9.	Feb. 16.
New Eng. Tel.	—	—	Erie Tel.	63	*62
Mex. Tel.	2¼	2½	Gen. Elec., pfd.	—	160
Westing. Elec.	—	60	Am. Tel. & Tel.	163	162
Westing. Elec., pfd.	—	—	Boston Elec. Light	210	210

PHILADELPHIA.

	Feb. 9.	Feb. 16.		Feb. 9.	Feb. 16.
Elec. Stor. Bat.	75	70	Phil. Elec.	7⅝	7⅜
Elec. Stor. Bat., pfd.	75	75	Pa. Elec. Veh.	—	2
Elec. Co. of Am.	8⅛	8⅞	Pa. Elec. Veh., pfd.	—	1
Gen. Elec. Auto.	—	—	Am. Rys.	33	35½

CHICAGO.

	Feb. 9.	Feb. 16.		Feb. 9.	Feb. 16.
Chicago Edison	150	150	Chicago Telep. Co.	260	260
Chic. City Ry.	255	256	Union Traction	12	13¾
Nat'l Carbon	16	18	Union Traction, pfd.	53½	55
Nat'l Carbon, pfd.	83	83	Northwest. Elev. Com.	34	33

* Asked.

LOCKPORT POWER SCHEMES.—A special dispatch from Lockport, N. Y., of Feb. 7 says: The Whitney-Elkins syndicate has a big scheme on in this part of the State, which will involve millions. Those who are informed say that the same men who recently purchased the Buffalo & Depew trolley line are behind the Buffalo, Rochester & Niagara Falls Electric Railway Company's ridge road project, the water company which desires to furnish Lockport with water, and the Niagara, Lockport & Ontario Power Company, which has offered to construct a power canal from Niagara River to this city. S. Q. Mingle and the Depew Investment Company are known to be associated with the Philadelphia and New York men who have purchased the Buffalo & Depew line, and Mr. Mingle and the American Pipe Company of Philadelphia are backing the water and power companies referred to. The Ridge Road Trolley Company has said that it will take its supply of power from the Lockport power canal, if the canal is built, and there is evidence that it is interested in the construction of this canal. Two capitalists have gone over the route of the proposed Buffalo, Rochester & Niagara Falls trolley line, and it is said on pretty good authority that the interests of all the companies named will be consolidated and that the capitalists interested will build the trolley line, construct the power canal and provide Lockport with water.

ALASKAN LIGHTING DEAL.—A special dispatch from Seattle, Wash., of Feb. 2 says: "C. R. Collins, formerly manager of the Seattle Gas & Electric Company, has purchased a controlling interest in the Alaska Light & Power Company, operating an electric light plant at Skagway. The Skagway *News* of recent date speaks of the purchase as likely to lead to substantial improvements in the plant. It is stated that new boilers and modern dynamos are to be immediately installed. It appears that Mr. Collins sent an expert in electric light plant construction to examine the property, and on his favorable report made the investment. Charles B. Hurley of Tacoma, who is president of the company, still retains an interest in the concern, it is said.

BALTIMORE TROLLEYS.—Hambleton & Company report the earnings of the United Railways & Electric Company of Baltimore for the year ended Dec. 31 as follows:

	1900.	1899.	Changes.
Gross	$4,431,742	$4,274,304	Inc. $157,438
Expenses	2,059,559	1,948,363	Inc. 111,195
Net	$2,372,183	$2,325,941	Inc. $46,242
Fixed charges and taxes	2,327,980	2,198,339	Inc. 129,640
Net revenue	$44,203	$127,602	Dec. $72,398

TELEPHONE, TELEGRAPH & CABLE COMPANY OF AMERICA.—The Telephone, Telegraph & Cable Company of America stockholders have elected the following directors: Joseph McCall, F. M. Jenks, C. W. Morse, H. Gawtry, G. Crocker, O. Ames, F. Tilford, Daniel O'Day, G. F. Hawkins, H. R. Wilson, W. J. Latta, F. M. Riter, R. Morgan, J. L. Welsh, J. D. Crimmins, E. R. Chapman, Samuel Thomas, J. C. Bullitt, J. J. Sullivan, M. W. Ayers and G. W. Elkins. The first eleven are members of the old board. In some quarters the opinion prevails that the management is not as yet quite positive that all the new directors will qualify.

ERIE TELEPHONE.—Although the subsidiary companies of the Erie Telephone system have not made up their figures for 1900, it is understood that the estimates show gross earnings of $4,950,000, or an increase over the previous year of $1,273,000. The net earnings are estimated at $1,760,000, an increase over 1899 of $487,000. The total number of telephone subscribers to this system was, on Dec. 31, 1900, 141,599. The net gain in subscribers, as compared with the previous year, was 35,041. It is estimated that the gross income for 1901 should be $6,500,000. If there were no gain in subscribers during the year, gross business would be not far from $6,000,000.

DETROIT UNITED RAILWAY.—At a meeting of the directors of the Detroit United Railway Company the following officers were elected: President, Henry A. Everett of Cleveland; vice-president and treasurer, Jere C. Hutchines of Detroit; secretary, A. E. Peters of Detroit. Three of the directors—R. T. Wilson, M. Orme Wilson and James M. Edwards of New York—retired from the board, and their places were taken by E. W. Moore of Cleveland, Arthur Pack of Pontiac, Mich., and H. B. Vancourtlandt of New York.

BOSTON EDISON.—The Edison Electric Illuminating Company of Boston will petition the Gas & Electric Light Commissioners for authority to issue between 6000 and 7000 shares of new stock. Edison stock is now selling for about $250 per share and if the gas commissioners approve the issue of new stock they will undoubtedly place a value on the new stock in excess of $200 per share, which will give the Edison Company at least $1,400,000 of new capital.

DIVIDEND.—The American Railways Company directors have declared a dividend of 1 per cent (50 cents a share) payable March 15. Books close March 1 to March 15, inclusive.

BOSTON LIGHTING CONSOLIDATION.—The directors of the Edison Electric Illuminating Company and of the Boston Electric Light Company are reported to be again holding conferences with a view to consolidation. The proposed basis of consolidation is said to be somewhat similar to the original "Morgan" plan as to interest return of 11½ per cent and 10 per cent, respectively, to Edison and Boston Company stockholders, but the proposed amalgamation will be in the nature of a consolidation rather than a lease by a third company.

PHILADELPHIA & WESTCHESTER.—The gross receipts of the Philadelphia & Westchester Traction Company for the fiscal year ending Dec. 1, 1900, were $93,515, an increase of $7,532. The stockholders, at their annual meeting, authorized the allotment of $100,000 of the treasury stock to the present stockholders at par ($50 per share, payment for the same to be made in cash), each present stockholder having the right to subscribe to one share of new stock for each five shares of the old stock held by him, the privilege to be exercised by Feb. 1.

WESTERN UNION STRENGTH last week was largely due to reports of some arrangements to be made between Western Union and the Postal Telegraph Company. One of the reports in circulation is that the Postal Company is willing to give a collateral trust 5 per cent bond for each 10 shares of Western Union stock, with a view of controlling the Western Union Company. Another report was exactly the reverse of the above. A third report dealt with Western Union control of a Pacific cable.

CHICAGO TRACTIONS.—Mr. Charles Yerkes denies that he has sold his traction stock which is necessary for the reported change in control. There is little doubt of a change in the ownership of Union Traction sooner or later. It is authoritatively stated in Chicago that Thomas F. Ryan has purchased control of Union Elevated, Lake Street Elevated, Northwestern Elevated and Chicago Union Traction. Mr. Ryan was seen and refused to discuss the subject.

LONG ISLAND GAS.—Wilson & Stephens have purchased the Long Island Gas, Electric & Water Company, the Long Island Illuminating Company and the Suburban Electric Light Company, all operating in and around Jamaica and Hempstead. It is supposed that these properties will be merged or consolidated with the New York & Queens Electric Light & Power Company.

MEXICAN TELEPHONE shows, net, for 10 months, a gain of 385 subscribers, to 3385, and a gain in net earnings of $16,027, up to $69,233.

Commercial Intelligence.

THE WEEK IN TRADE.—Reports received by the commercial agencies as to the trade conditions indicate a very satisfactory state of affairs at all centres, and general confidence as to the outlook for the year is manifest. All things considered, prices are strong, and the Western and Southwestern trade continues to be of large volume. In the iron trades, the strength of prices increased as a result of the reports of pending consolidations, although the volume of business was restricted from the same cause. Structural material is active, and the largest consumption since 1895 is looked for. The gross earnings of 108 roads for the calendar month, according to *Bradstreet's*, aggregate $58,366,708, a gain of 8.1 per cent over January a year ago, which showed an increase of 16 per cent over 1899 and following progressive gains in January, ranging from 8 to 15 per cent, for a period of years past. This compares with a gain of 8.8 per cent in December and of 2 per cent in November. The Southwestern roads showed the heaviest gains, 25 per cent, and the grangers the smallest, 3.6 per cent. Mexican road earnings fell off 2.5 per cent from last year. The number of business failures during the week, as reported by *Bradstreet's*, was 226, as against 250 the week previous, and 199 during the corresponding week last year. In the metal market, copper continues very firm, and the prominent producers are large sellers at full prices, 17c. for Lake and 16⅝c. for electrolytic. Buyers are purchasing freely for home consumption. The production of January, according to John Stanton's estimates, was as follows: Mines reporting, 19,279 tons; outside sources, 3400 tons; total, 22,679 tons, as compared with 21,013 tons during January, 1900.

THE C & C ELECTRIC COMPANY, of New York City, has secured a contract for the supply of a large lighting and haulage plant, including two 25-kw generators, switchboard and all supplies for the Montezuma Copper Company, Mexico. Other recent foreign orders comprise four 25-hp and the same number of 6-hp slow-speed motors for shipment to South America; two 40-kw vertical generators to be utilized for driving Wheeler condenser fans in the main generating plant of the Lisbon Tramways Company, Portugal, and five 4-kw generator sets for marine work at Manila. The same New York concern's recent domestic orders include one 175-kw belted generator for the Chicago Shipbuilding Company, one 25-kw and one 50-kw generator and engines, also switchboard, for the Hotel Albert, New York City; three 60-kw generators for the Weed Apartment House, Central Park West, New York City; two 25-kw engine type generators for another large New York apartment house; two 80-kw generator engines and switchboards for the plant of the Defender Manufacturing Company of New York City; one 75-hp variable speed motor for the Nairn Linoleum Company of Kearny, N. J., while a 50-hp series-parallel printing press equipment is about to be shipped to one of the leading newspaper plants in Portland, Ore.

CUBAN LIGHTING CONTRACTS.—A cable dispatch from Santiago de Cuba of Feb. 17 says: The municipal authorities of Santiago express surprise and displeasure at the postponement until March 1 of the opening of tenders for the new electric lighting plant. The advertisements which appeared some months ago announced Tuesday, Feb. 19, as the date. All the official requirements had been complied with, and representatives of New York and Pittsburg syndicates came here some time ago to make arrangements to bid and to deposit the necessary bonds. A local syndicate also qualified. At the last moment Señor Selis, of Havana, who is a partner of a brother of Señor Tamayo, Secretary of State and Government, secured a postponement. American and local capitalists charge him with an improper use of political influence, and some of them announce that they will retire from competition for the contract. The city is poorly lighted and the public generally condemns Havana authorities for hindering important local improvements here in this respect.

THE PHILIPPINES.—A correspondent in Manila writes us: "This is a fine city and since McKinley's election things are going forward with a boom. It is one of the busiest places I have ever seen and the harbor almost reminds one of New York. There are great chances here for almost any kind of work, particularly in the electrical and engineering side. We need American trolley lines badly, American machine shops and an American bank, which would prove a gold mine here in the city of Manila. The Civil Commission has just appropriated $1,000,000 in gold to improve the harbor. It is a compact legislative body and is dispatching business in an efficient manner. Manila is destined to be one of the greatest commercial and shipping centres of the far East."

CENTRAL STATION AUTOMOBILES.—The Electric Vehicle Company has sold two of its Mark XII runabouts to the Hartford (Conn.) Electric Light Company. One is to be used by the superintendent for inspection purposes and the other by the head repair man for hurry calls. It is said that the lighting people gave the subject of electric automobiles considerable study before buying, and the selection of these vehicles carries with it, therefore, no small significance. The only wonder is that central stations, with the possible sale of so much current at stake, have not been more enterprising in this direction, setting a shrewd example in each community.

THE INTERNATIONAL BRASS & ELECTRIC COMPANY, Incorporated, has been formed, virtually a successor to the International Electric Company. Edwin Huerstel is president, Robert A. Scott vice-president and Gustave Huerstel secretary and treasurer. Headquarters are at 76 Beekman Street, New York City, where it will continue with enlarged facilities the production of Ruhmkorff coils, general electrical devices and small machinery.

ELECTRIC LIGHT CABLE FOR NEW SOUTH WALES.—The New South Wales Government Railways is advertising for the supply, delivery and laying of about 29 miles of 6600-volt, three-core lead-sheath cables, and about 2 miles of other cables, together with the necessary materials and labor for laying. The contract closes March 4. The office of the electrical engineer is at 51 Philip Street, Sydney.

THE EASTERN ELECTRIC COMPANY has removed its incandescent lamp manufactory from Middleton, Mass., to Lynn, Mass., where it occupies a larger and more convenient factory at 217 Market Street. Here it is able to turn out its well-known product, "Eastern" lamps, in largely increased quantities. Its main office is, as heretofore, in Boston.

STATION EQUIPMENT FOR SALE.—The Allegheny County Light Company, of Pittsburg, Pa., is about to abandon the Broad Street power house in the East End, and the company is now advertising in various papers the sale of all the old apparatus in that station, amounting to a capacity of about 15,000 incandescent and several hundred arc lights. The entire outfit is to be sold together.

THE AMERICAN BRIDGE COMPANY is to furnish Cooper & Wigand with about 2800 tons of structural steel for the Kingsbridge Road power house of the Third Avenue Railroad, New York City. Its Gillette-Herzog branch will furnish the steel work for the large steel building which is to be shipped to the Montezuma Copper Company at Nacozani, Mexico.

BATTERIES WANTED.—The Springfield, Mo., Plumbing Company, E. L. Hoke manager, is desirous of receiving quotations on carbon open-cell batteries, with catalogues, etc.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended Feb. 6: Antwerp—16 cases electrical machinery, $2,782; 20 packages electrical material, $733. Amsterdam—1 box electrical material, $15. Argentine Republic—18 packages auto vehicle parts, $1,800; 18 packages electrical material, $350. Brussels—1 package electrical material, $49. Bremen—5 cases electrical material, $840. Brazil—3 packages electric railway material, $595; 60 packages electrical material, $5,359. British West Indies—18 cases electrical material, $227; 1 motor vehicle, $900. British East Indies—8 cases electrical material, $442. Central America—136 packages electrical material, $2,379. Chili—39 packages electrical material, $1,758. Cuba—211 cases electrical material, $5,048. Dutch West Indies—2 packages electrical material, $25. Dutch Guiana—2 cases electrical material, $25. Dutch East Indies—19 cases electrical material, $279. Ecuador—1 case electrical material, $23. Glasgow—81 packages electrical material, $34,177; 18 packages electrical machinery, $175. Genoa—101 packages electrical material, $12,430. Hull—34 cases electrical material, $5,828. Hayti—4 packages electrical material, $158. Havre—10 packages electrical material, $985. Halifax—1 case electrical material, $18. Hamburg—76 packages electrical material, $2661; 1 package electrical machinery, $100. London—4 packages electrical machinery, $1,015; 114 packages electrical material, $12,870; 1 case motor vehicles, $880. Liverpool—434 cases electrical machinery, $19,940; 149 packages electrical material, $28,969. Mexico—1147 cases electrical material, $15,547; 35 packages electrical machinery, $14,950; 3 packages auto vehicles, $2,000. Manchester—66 packages motor trucks, $3,200. Milan—1 case electrical material, $28. Newfoundland—1 package electrical material, $66. Newcastle—105 cases electrical machinery, $4,871. Nova Scotia—18 packages electrical material, $586. Peru—45 packages electrical material, $658. Palermo—1 case electrical material, $7. Rotterdam—6 cases electrical material, $60. Riga—2 cases electrical material, $306. Ramsgate—26 packages electrical machinery, $4,000. Southampton—4 packages electrical material, $213. United States of Colombia—16 cases electrical material, $289. Venezuela—55 packages electrical material, $818.

A. L. BAGNALL, of the American electrical engineering and contracting firm of Bagnall & Hilles, of Singapore, Manila and Yokohama, left New York last Saturday en route for San Francisco, from which place he intends to sail for Japan about March 1. The numerous contracts placed by Mr. Bagnall during his three months' sojourn here—which, it will be recalled, were duly noted in these columns—will very likely be considerably augmented before he leaves the United States, as he proposes to stay over a week or ten days in Chicago and other Western cities for the purpose of closing some important deals. Such transactions will be made necessary in view of his having received notification from Japan on the eve of his departure from New York that his firm has secured the contract for the conversion of a steam road in Tokio into electrical power. All the orders for equipment, however, may not be determined upon until he personally goes into details in Tokio. He anticipates expending fully $250,000. It may be well to state that the above-mentioned road has no connection with the new Tokio Electric Railway Company, contracts for which amounting to $300,000 have already been placed. Mr. Bagnall while in Chicago will make his headquarters at the local offices of the New York Insulated Wire Company, at 320 Dearborn Street.

THE AUTOMOBILE & CYCLE PARTS COMPANY, of Cleveland, Ohio, is now being incorporated, with $5,000,000 capital stock, to manufacture and sell automobile and bicycle parts, carriage fittings and hardware specialties of all kinds. The company has recently taken over all the parts and fittings plants until recently controlled by the American Bicycle Company, and the storage battery business formerly owned by the Cleveland Machine Screw Company; also the sheet steel plant at Chicago owned by Hart & Cooley. The board of directors of the new company will include A. L. Garford, formerly treasurer of the American Bicycle Company; Windsor T. White, general manager of the White Sewing Machine Company, Cleveland; J. D. Climo, formerly secretary of the Cleveland Machine Screw Company, Cleveland; E. H. Hill and E. H. Bourne, Cleveland bankers, and M. B. Johnson, a prominent attorney. The company also has options on several other plants of a nature similar to those above mentioned. The general offices of the company will be in the American Trust Building, Cleveland.

THE NEW YORK GLUCOSE COMPANY, which is equipping a huge plant at Shadyside, N. J., has just decided as to the placing of some of its important machinery contracts. The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, through its New York manager, Mr. George W. Neff, has been awarded the contract for the furnishing of oil mill, pumping and filtering machinery, having a capacity for extracting the oil from the germ yield of 20,000 bushels of corn every 24 hours. This machinery will be electrically driven. The electrical portion of the contracts will be closed during the latter part of this week. Thos. Gaunt, the chief engineer of the Glucose Company, states that it is now prospecting for a water supply in Hackensack Valley for the purpose of supplying their plant, which will use 4,000,000 gallons per 24 hours.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has secured a contract for the shipment of a complete electric lighting plant, which is intended for utilization in the machine shops of the Guayaquil & Quito Railroad, Ecuador. Henry Potter, of the Westinghouse Company, has just returned from a six months' tour in South America. Mr. Potter's mission was principally made with a view to look up the various Westinghouse agencies in that part of the world. He reports that the outlook for increased sales in electrical machinery is very promising, particularly in the Argentine Republic, Chili and Peru.

THE HAVANA ELECTRIC RAILWAY COMPANY continues to make heavy purchases here. McAvoy & Co., of Philadelphia has been awarded the contract for the furnishing of 4,000,000 paving bricks. The contract, which was placed through the Morris Electric Company, of New York City, is said to be worth nearly $90,000. The Morris Company has recently secured miscellaneous orders for engine supplies, tools and such like for shipment to both the Lisbon and Mexico City Tramways. These orders are stated to have aggregated close on $18,000.

ORDERS FOR WATERTOWN ENGINES received recently are two 100-hp engines direct connected to Bullock generators for the Jacob Ruppert Brewing Company; two 125-hp engines direct connected to Westinghouse generators for the St. Bartholomew Mission House, Forty-second Street and Third Avenue; two 150-hp engines direct connected to Sprague generators for the Manhattan State Hospital at Central Islip; two 350-hp belted engines for the Oxford Paper Company at Rumford Falls, and four 80-hp direct connected engines for apartment houses in New York City.

BLAKESLEE & COMPANY, of New Haven, Conn., are at present distributing a number of contracts for equipment, etc., required by the Wabash & Peoria road. The American Car Company, of St. Louis, has obtained an order for 12 car bodies, the trucks for which are being built by the McGuire Manufacturing Company, of Chicago. Ten thousand rail bonds have been ordered of the Morris Electric Company.

THE ANNESS-FREEMAN COMPANY, recently incorporated at Springfield, Ohio, to manufacture motors, generators and other electrical appliances, has organized with the following officers: W. P. Freeman, president; George Duerch, vice-president; W. A. Utz, second vice-president; Louis Utz, secretary; W. H. Anness, treasurer. The company will secure a site at once and erect a plant as soon as possible.

THE YOUNGSTOWN CONSOLIDATED GAS & ELECTRIC COMPANY, Youngstown, Ohio, has filed a mortgage deed for $500,000 in favor of the New York Security & Trust Company. The bonds are payable Jan. 1, 1931, and bear 5 per cent interest, payable semi-annually. A number of improvements will be made to the local lighting plant.

THE COMPANHIA MINEIRA DE ELECTRICIDADE, Juiz de Foia, Minas, Brazil, is extending its plant and is at present making some fair-sized purchases of machinery in this market. Both the Westinghouse Electric & Manufacturing Company and the Stilwell-Bierce & Smith-Vaile Company have secured orders for electrical machinery and water wheels, respectively.

THE AMERICAN ELECTRICAL HEATER COMPANY, of Detroit, Mich., has received a very large order for its telephone soldering irons from one of the largest electrical manufacturing concerns in France. This order was given after thoroughly testing these irons at telephone work.

THE RUSSIAN GOVERNMENT is about to place contracts for the furnishing of 6000 water meters required by the municipal water works of St. Petersburg. The National Meter Company, of New York City, is figuring on the contract, which, it is estimated, will be worth in the neighborhood of $400,000.

CORNER BROS. & COMPANY, of New York City, which concern acts as financial agent for a London company operating various South African breweries, is inquiring for electrical machinery to be utilized in said plants.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY of Cincinnati, Ohio, has been awarded a contract for the supply of a 400-hp direct connected motor, which is to be installed in the plant of the Montreal (Can.) Water & Power Company.

THE PELTON WATER WHEEL COMPANY, of New York City, is about to export 500 tons of piping for a power plant in South Africa.

THE J. G. BRILL COMPANY, of Philadelphia, has obtained an order calling for the shipment of several snow plows for the Genoa Tramways, Northern Italy.

MUNICIPAL PLANT.—The city civil engineer of Mansfield, Ohio, has been instructed to secure estimates and prepare plans for a water works pumping station and a municipal lighting plant.

Telephone News and Notes.

RIPLEY, OHIO.—The Ripley Telephone Company, a newly organized independent company, has been granted a franchise.

VAN BUREN, IND.—The Van Buren Telephone Exchange operates a 100-drop board and has 65 subscribers. An increase is expected.

ADA, OHIO.—The Ada Telephone Exchange Company has increased its capital stock from $10,000 to $30,000. Improvements will be made.

PORT CLINTON, OHIO.—The Central Union Telephone Company will soon open an exchange in this place. About 130 subscribers have been secured.

MARION, OHIO.—The Marion County Telephone Company, a recently organized independent company, has applied for a franchise for a city exchange.

SYRACUSE, IND.—The Syracuse Telephone Company is doing an excellent and steadily progressing business. It has a 100-drop board and 110 subscribers.

LEAVENSWORTH, IND.—The Crawford County Telephone Company operates a 100-drop board and has 60 subscribers. Considerable increase is projected.

MILWAUKEE, WIS.—The Wisconsin Telephone Company reports a net gain of 206 subscribers in January, making a total number of 20,749 subscribers on Jan. 31.

INDIANAPOLIS, IND.—The New Telephone Company has paid the city its semi-annual installment of $3,000, compensation to the city for the use of the streets.

WHITEHALL, WIS.—The Arcadia Telephone Company has American Electric apparatus, a 50-drop board and 40 subscribers, with more than that number in prospect.

HOYES, MD.—The Garrett County Telephone Company has 75 subscribers and American Electric apparatus. A number of improvements are projected and prospects are good.

LAKE CREEK, TEX.—The Southern Telephone Company, which has Western Electric apparatus, operates a 50-drop board and has 40 subscribers. Its outlook could not be better.

INDIANAPOLIS, IND.—A bill has been introduced in the Legislature requiring telephone, telegraph and electric light wires to be at least 25 ft. above the ground at all railway crossings.

NEW FLORENCE, MO.—The People's Telephone Company has been incorporated with a capital stock of $3,100. The incorporators are Howard Ellis, T. M. Marlow, W. C. Crone and others.

SALEM, OHIO.—The Columbiana County Telephone Company installed 110 new telephones in Columbiana County during January. The local exchange is now in direct connection with Pittsburg.

HILLSBORO, IND.—The manager of the Hillsboro Telephone Company, Mr. Wright, informs us that the prospects are excellent. With a 300-drop board, it has 275 subscribers, with a steadily increasing list.

SABETHA, KAN.—The Sabetha Telephone Company uses American Electric and Stromberg-Carlson apparatus. It operates a 200-drop board and has about 135 subscribers. The future looks very promising.

WABASH, IND.—The United Telephone Company, which owns a system of telephone toll lines in Northern Indiana, has purchased the line built along the Cudahy oil pipe line from Beufflon to Kankakee, Ill.

LA RUE, OHIO.—The La Rue Telephone Company, recently organized, is preparing to install its exchange. Over 200 subscribers have been secured. It is expected that the exchange will open with about 300.

PLYMOUTH, WIS.—The Plymouth Telephone Company at a recent meeting elected officers as follows: President, C. Pfister; vice-president, B. W. Rowe; secretary, C. D. Eastman; treasurer, H. W. Hostman.

RIO, WIS.—The People's Telephone Company has been incorporated with Y. L. Farrington as president. The company will take possession of all the lines formerly operated by the Farrington Telephone Company.

APPLETON, WIS.—The toll line of the Fox River Valley Telephone Company, between this city and Kaukauna is now in operation. The company will place its wires underground through the main part of this city.

WORTHINGTON, OHIO.—The Citizens' Telephone Company of Columbus has secured a franchise for a local exchange with direct connection with Columbus. The Central Union Telephone Company was refused a franchise.

CAPE GIRARDEAU, MO.—The Cape Girardeau Telephone Company has apparatus of the American Electric Telephone Company, 700-drop board capacity and 625 subscribers, with 100 miles of toll line and a large expected increase.

ASHLAND, VA.—The General Assembly of Virginia has granted a charter to the Henrico Telephone & Telegraph Company, capital, maximum, $5,000; minimum, $1,000. W. C. Saunders and others are directors. The home office is at Ashland.

SOUTH MILWAUKEE, WIS.—The Southern Telephone Company, incorporated by G. Long and F. Koch, of South Milwaukee, and W. J. Sutton, of Milwaukee, has applied to the Common Council of South Milwaukee for a 25-year grant for a telephone system.

CHARLOTTE, N. C.—A special from Barnwell, S. C., says that the exchanges and toll lines of the Southern Telephone & Telegraph Company have been sold to the South Carolina Long Distance Telephone Company. S. H. Brown is president of the former company.

SHEBOYGAN, WIS.—The Northwestern Telephone Company will soon begin stringing wires from this city to Plymouth, thence south of Fredonia in Ozaukee County. At Plymouth connection will be made with the Little Wolf Company, which has a line in operation to Fond du Lac.

KNOXVILLE, TENN.—Frederick E. Judson, of Nashville, Tenn., has been appointed as manager of the Knoxville (Tenn.) exchange of the Cumberland Telephone Company. Mr. Judson has served the company in Nashville, Jackson, Tenn., Louisville, Evansville and other points.

ST. LOUIS, MO.—At the February meeting of the St. Louis Railway Club, held a few days ago, a paper was read by President Miller of the American Telegraph & Telephone Exchange, submitting a plan for a railroad telegraph and telephone exchange for St. Louis and East St. Louis.

SAN FRANCISCO, CALIF.—The Pacific States Telephone & Telegraph Company has just completed an additional loop from San Francisco to Los Angeles. The new construction extends from San Pablo, 12 miles from Oakland, via Bakersfield, and the line is of 7-strand aluminum.

TRENTON, N. J.—The Keystone State Telephone & Telegraph Company, with $2,000,000, has been incorporated. The incorporators are Norman Grey, Edward H. Chew and Wilfred B. Wolcott, all of Camden. It is believed that large moneyed interests in Philadelphia are back of the company.

ALTON, ILL.—The fight between the Kinloch Telephone Company and the Central Union Telephone Company of Alton has been ended by the granting to the Kinloch Company of a franchise. The Central Union Company is expected to cut its rates when the Kinloch telephones are in opeartion.

GUTHRIE, OKLA.—The Osage Telephone Company, which was recently chartered, expects to build toll lines from Elgin, Kan., to Cleveland, Okla., and from Bartlesville, I. T., to Ponca City, Okla. It will also establish an exchange at Pawhuska. The total length of the lines will be 142 miles.

DAWSON, KLONDIKE.—The Yukon Telephone Syndicate operates an extensive system in this region. It has 143 telephones in Dawson, 21 in Grand Forks, 14 in Bonanza Creek, 6 in Eldorado Creek, 3 in Gold Run, 2 in Dominion and one each at Sulphur Creek and the Dome Road House—a total of 191.

CENTRAL LEBANON, OHIO.—The Valley Telephone Company has a 200-drop board at Lebanon, 100 at Mason and 200 at Waynesville. There are 400 subscribers, 100 within a month, and it contemplates two more exchanges. We are indebted to Mr. Roll, manager, for this information, who says that prospects are very good.

MONROE, N. C.—The Carolina & Virginia Telephone Company has drop board capacity at Rock Mount of 250, Greenville 130, Chase City, Va., 50, and Clarksville 75. Henderson apparatus is used. There are about 500 subscribers. The company is now building three exchanges and 100 miles of toll line in Virginia. Its prospects are very good.

SEATTLE, WASH.—The Independent Telephone Company, operating in Seattle, Wash., under the franchise recently granted to J. S. McGroarty and others, has elected the following board of trustees: E. W. Andrews, J. W. Clise, E. E. Burwell, Sherwood Gillespy, W. H. White and J. S. McGroaty of Seattle, and Charles Kurtz of Columbus, Ohio.

INDIANAPOLIS, IND.—W. L. Hill, manager of the Central Union Telephone Company, has announced that on April 1 the company will offer on independent lines a residence service at $24 and $36 a year. The $24 service is with a Blake transmitter; the other has a solid back, long-distance transmitter. The party line rates will remain as heretofore, six on a line at $18 a year.

NEW LONDON, WIS.—The Wolf River Telephone Company has secured connections with 100 stations in Appleton and Kaukauna through the Fox River Valley Telephone Company, with Plainfield and Hancock through the Almond Telephone Company, with Grand Rapids through the Union Telephone Company and with Marshfield through the Wood County Telephone Company.

DAYTON, OHIO.—The Dayton Home Telephone Company, which, two years ago, was refused a local franchise, has applied to the Probate Court for a grant. Under a new ruling of the Supreme Court, the Probate Court has the right to grant a franchise where the city and company cannot agree. The company offers residence telephones at $28 per year and office lines for $40 per year, with a discount of $1 per quarter for cash payment of bills.

LOGANSPORT, IND.—The City Council on Feb. 8 passed the telephone ordinance submitted by citizens, which opens the field to all competition, under the restricted rates of $12 and $18 per year. If the Bell Company declines to accept the terms of the ordinance, a citizens' company will occupy the field. The Council also authorized the bringing of a suit to revoke the Mutual Company's franchise, which is alleged to be the property of the Bell Company.

WAUSAU, WIS.—The report of the directors of the Wausau Telephone Company shows that the value of the plant is $19,500. The total amount of stock sold is $7,800, leaving $11,700 that has been paid out of the earnings of the company. During the year 18 per cent, or $1,130, was paid to stockholders for dividends, making the cash dividends in five years 68 per cent. These earnings were exclusive of the large sum used in extending and improving the plant. The company is in a very flourishing condition and now has 454 telephones in use.

ZANESVILLE, OHIO.—The Zanesville Telephone & Telegraph Company, which has recently secured a franchise from the Probate Court, has consolidated with the Zanesville Citizens' Telephone Company, continuing the name of the former. The capital stock has been increased from $100,000 to $200,000, and officers have been elected as follows: Sherman M. Granger, president; W. D. Schultz, vice-president; H. A. Sharpe, secretary and treasurer; J. B. Rhodes, general manager, and Maxine Reber, Cleveland, consulting engineer. The company is backed by the United States Telephone Company of Cleveland, and J. B. Hoge and Harry Critchfield are among the directors. The present system will be rebuilt and a new exchange building erected.

TELEPHONE NEWS.—(Continued.)

HOOP POLE, ILL.—Mr. A. Mathis informs us that a large board is to be put in here to connect with other lines.

MEMPHIS, TENN.—The Citizens' Telephone Company of this city has applied for permission to begin construction work at once.

NATCHITOCHES, LA.—The Natchitoches Telephone & Electric Light Company uses American Electric apparatus, has a 100-drop board and 98 subscribers.

GRANT CITY, MO.—The Grant City Telephone Company has American Electric apparatus, a 100-drop board and 98 subscribers. An increase is projected.

DIVIDE, ILL.—The Farmers' Telephone Company has D. A. Kusel apparatus, toll line board for five toll lines and 24 subscribers. This is a local toll line company.

REYNOLDS, ILL.—The Reynolds Telephone Company has 175 subscribers and a 60-drop board. The increase has been good and prospects are better. Mr. M. Schoonmaker is president.

MENTOR, OHIO.—The Mentor Telephone Company operates a 100-drop board and has 60 subscribers. Apparatus of the North Electric Company is used. Its prospects are very good.

WAVELAND, IA.—The Waveland Telephone Company operates a 120-drop board and has 180 subscribers. It intends rebuilding several of its lines. It uses Sterling Electric apparatus.

ABBEVILLE, GA.—We are indebted to Mr. S. L. Hoton for the following: His apparatus is of Phœnix make and he operates a 100-drop board with 76 subscribers. He looks for many more.

LAKEVIEW, MICH.—The manager of the Union Telephone Company, Mr. J. W. Kirtland, informs us that the company operates a 100-drop board, has 43 subscribers and excellent prospects.

SALEM, S. D.—The Salem Telephone Company uses Western Telephone apparatus, has a 100-drop board and 81 subscribers. It is not yet a year old, but is flourishing and paying good dividends.

BRECKINRIDGE, MO.—The Breckinridge Telephone Company has a 100-drop board and 93 subscribers, using American Electric Telephone apparatus. The prospects are good for more subscribers.

VINTON, IA.—The Vinton Telephone Company operates a 300-drop board and has 252 subscribers. It has put in 20 new telephones this year and expects a large increase. Mr. Lichty is the manager.

NEVADA, MO.—The Nevada Telephone Company has Sterling, Ericsson and Swedish-American apparatus, a 435-drop board and 347 subscribers. The addition of a large number of subscribers is looked for.

FREMONT, IA.—The Farmers' & Traders' Telephone Company has Stromberg-Carlson apparatus, a 50-drop board and 22 subscribers. Business is steadily increasing. This year will be favorable for extensions.

HALEY'S MILL, KY.—The Haley's Mill Telephone Company uses Stromberg-Carlson apparatus, has a 30-drop board and 20 subscribers. A 30-mile line has recently been built and another is projected. Prospects are good.

FLEMINGSBURG, KY.—Mr. B. B. Stone, electrician of the Flemingsburg Telephone Company, informs us that prospects are very good. The company operates a 100-drop board, has 82 subscribers and improvements are contemplated.

HENRIETTA, MICH.—The Henrietta Telephone Company informs us, through Mr. J. M. Fuller, manager, that it has apparatus of the North Electric Company, 16 farmers' lines and about 175 subscribers. Its outlook is very favorable.

EDGAR, NEB.—The Edgar Telephone Company uses apparatus of the Central Telephone & Electric Company of St. Louis and has a 100 drop board and 100 subscribers. It has just started and expects to double the number of subscribers soon.

MORGANSFIELD, KY.—The Morgansfield Telephone & Telegraph Company has in its Morgansfield exchange a capacity of 300 lines, and at Sturgiss 150, the apparatus being mostly of the Stromberg-Carlson Company. It has a total of 450 subscribers.

MAGNOKETA, IA.—The Magnoketa Telephone Company has Eureka apparatus and a 200-drop board, all full metallic. Another 200-drop board is projected. It has 225 subscribers and will add another hundred as fast as the work can be done.

ROCKPORT, ILL.—Mr. W. H. Gay, secretary of the Rockport & El Dara Telephone Company, informs us that its apparatus is of Stromberg-Carlson make. This is a party line plant, using not more than 8 instruments per line. The service is efficient and economical.

MORNING SUN, IA.—The Morning Sun Telephone Exchange has just started business with 56 subscribers. It has a 70-drop switchboard of the Western Electric Company's make. Some large extensions are projected. Mr. B. T. De Long is manager of the company.

BLAND, N. M.—Mr. Graves, of the Albemarle-Bland Telephone Company, informs us that it operates a 25-drop board with 24 subscribers. A new 60-drop board is to be put in this spring and the outlook is fine. It uses Standard Telephone & Electric Company apparatus.

CREIGHTON, NEB.—The Theisen & Diehl Camp Dewey Telephone Company and the Diehl & Thiesen Creighton Telephone Exchange Company, operate a 100-drop board and have 130 subscribers. Two more exchanges are to be built, and future prospects are very good.

LA GRANGE, IND.—The Northern Indiana & Southern Michigan Telephone, Telegraph & Cable Company operates a 700-drop board with Stromberg-Carlson and American Electric apparatus. There are 900 subscribers and many more are expected. The prospects are for great success.

ANTELOPE, ORE.—We are informed by Mr. F. N. Wallace, of the Wasco Southern Telephone Company, that it operates a 10-drop board and has 25 subscribers. It has recently built a 32-mile line and projects two others to Ashwood and Mitchell, 25 and 50 miles, respectively.

TROY, KAN.—The Troy Telephone Exchange is using American Electric telephone apparatus, the board having 100 drops. It has 90 subscribers, 16 of whom are of recent acquisition. The company will build party lines and toll lines. Mr. S. P. Zimmerman is owner and manager.

GARNER, IA.—Mr. E. C. Abbey, of the Garner Electric Light, Power & Telephone Company, informs us that the company has a 100-drop board and has 80 subscribers and the number is constantly increasing. Its apparatus is from the Stromberg-Carlson Manufacturing Company. Its prospects are good.

MOUNT VERNON, IND.—We are indebted to the president of the Posey County Telephone Company, Mr. McGregor, for the following: The company uses Phœnix Electric apparatus, has a 100-drop board and 66 subscribers, with 4 farmers' lines. An exchange here is projected. The outlook is favorable.

WORTHINGTON, IND.—Mr. J. D. Myers, superintendent of the Worthington Telephone Company, informs us that prospects for rapid growth are excellent. Two toll lines are in course of construction and several farm lines are contemplated. It has Eureka Electric apparatus, a 200-drop board and 71 subscribers.

HIGH POINT, N. C.—The High Point Telephone Exchange informs us, through Mr. Hayden, its manager, that its subscription list has been doubled in little more than a year. It has Sumter Telephone Manufacturing Company apparatus, a 130-drop board and 118 subscribers. Full metallic lines are projected.

BOISE CITY, IDAHO.—The Idaho Independent Telephone Company, although only six months old, has made rapid strides. It has Stromberg-Carlson apparatus, a drop board of 1500 capacity, of which 500 are installed, and 380 subscribers. It is gaining about 50 per month and prospects are good for an increase. Mr. Clement is the secretary.

DANA, IND.—The Indiana Electric Company has lately been bought by Mr. E. Van Sickle. The two exchanges at Dana and Newport are furnished with Eureka Electric apparatus. Dana operates a 200-drop board, Newport 100. There are 225 subscribers and a large increase is looked for. The prospects are good for all the work that can be undertaken.

HUNTINGTON, IA.—The United Telephone Company has drop boards of 400 at Huntington, 300 at Bluffton and 300 at Portland, and 400, 300 and 230 subscribers. Larger boards at the first named places are projected and many farmers' lines are to be built. American Electric apparatus is used. Toll business is increasing and will necessitate doubling the capacity.

LEXINGTON, NEB.—The Lexington and Crozad telephone exchanges are owned and managed by Mrs. Eva Zimmerer, to whom we are indebted for the following items: The apparatus used is of Stromberg-Carlson make and the two places are connected by a toll line. The Lexington operates a 200-drop board and the Crozad exchange has 100 capacity and 50 drops. They have 175 and 45 subscribers, respectively, with excellent prospects of increase.

CHARLESTON, S. C.—The Bell Telephone Company has agreed to operate all the city telephones at the rate of $8 a year for three years. The contract calls for about 20 instruments. Bids were asked from the Bell Company and the Gordon Company, which is an independent concern, and cutting of prices was the result. The Bell Company claims that it will lose money by the deal, but prefers to lose rather than have the official business go to its rival.

PONTOTOC, MISS.—We are indebted to Mr. C. W. Bollon, manager of the Alabama, Mississippi & Tennessee Telephone Company for details of the very progressive corporation with which he is connected. It uses a Utica board with 100 drops and has 52 subscribers. The exchange is only one year old, but has a very encouraging future. It has about 100 miles of toll line branching out in various directions and extending to several towns. These lines are to be carried further and are all of first-class build.

LITTLETON, W. VA.—The Exchange Telephone Company is operating an exchange with 100-drop capacity, the switchboard being of the Keystone make and Standard telephones being used. The company has 250 subscribers and has trunk lines to Moundsville, New Martinsville, and 20 local lines to different points in Wetzel County. Mr. B. J. Ferral is secretary of the company and states that he expects to have 500 more instruments in use by next fall, and to get connected with Wheeling some time during the summer.

LAWRENCEBURG, MO.—The Lawrenceburg Telephone Company has about 100 miles of toll line running to Ash Grove, Mount Vernon, Miller and Everton, interchanging business with the lines of the other companies and connecting with about 75 or 100 different places in Lawrence, Green, Dade, Christon and Stone counties. It uses the apparatus of the Central Electric & Telephone Company of St. Louis, Mo. It has a switchboard with a capacity of 50 lines. The company has 15 subscribers at the present time and the outlook for more business is excellent.

PITTSBURG, PA.—A bill has been introduced in the State Legislature providing that no corporation, association, partnership or individual owning, operating or controlling any telephone line, shall acquire, either by purchase or otherwise, any competing telephone line, or the controlling interest in the stock or bonds of any competing line, or in any wise control, operate or own any competing line or the controlling interest in the stock or bonds thereof. The purpose of the bill is to prevent the consolidation of competing lines. If it becomes a law the bill will prevent any possibility of the purchase of the Pittsburg & Allegheny Telephone Company of this city by the Bell interests.

FRANKFORT, IND.—The Central Energy Telephone Company, one of the most prominent in the State, was incorporated in November, 1900, and began business last January with 300 subscribers, which number has been increased to 615 in little more than a month. The company is operating a board of 1200 drops and conducts a large long-distance toll service. It uses the Stromberg-Carlson central energy sytem. The company owns the building in which the exchange is located. Its toll service is conducted over copper metallic circuits in connection with the new long-distance company of Indianapolis. In addition to this it has several toll lines running to different points in the county. The plant was conceived and installed by Mr. John H. Murphy, a well-known telephone engineer of Indianapolis, assisted by Mr. Wm. Pogue as superintendent, who still retains this position. The most prominent men of Frankfort are members of the board of directors. The company enjoys an excellent business.

TELEPHONE NEWS.—(Continued.)

PULTENEY, N. Y.—The New York & Pennsylvania Telephone & Telegraph Company has 31 subscribers here.

ST. JOHN, KAN.—The St. John Telephone Company has a 100-drop board and 77 subscribers. It uses National Automatic apparatus.

GALVA, IA.—The Galva Telephone Exchange Company operates a 50-drop board with 53 subscribers. A 10-mile party line for farmers is contemplated.

ÔSKALOOSA, KAN.—The Oskaloosa Telephone Company reports business and prospects very promising. It has a 200-drop board and 150 subscribers.

ONLEY, VT.—The Onancock Telephone Company uses Keystone apparatus, has a 50-drop board and 42 subscribers. Prospects for the future are very good.

LAFAYETTE, IND.—The Shawnee Mound Telephone Company has Sterling apparatus and operates a 200-drop board. It has 195 subscribers and good prospects.

MISSOURI VALLEY, IA.—The Missouri Valley Telephone Company has a 200-drop board and 176 subscribers, 65 of whom were added last year. Mr. Kellogg is manager.

VERONA, OHIO.—The Eureka Telephone Company operates American Electric Telephone Company apparatus, has a 50-drop board and 15 subscribers and good prospects.

GLASGOW, KY.—The Glasgow Telephone Exchange Company, which operates American Electric apparatus, has a 200-drop board and 126 subscribers. Its outlook is very bright.

SHURMAN, IA.—The Shurman Telephone Company has 45 subscribers and a 100-drop board. The town is not large enough for much growth, but toll line business is increasing.

CHILLICOTHE, MO.—Messrs. Leach & McArthur operate a switchboard of 500-drop capacity and have 398 telephones. Increase of the last six months has been rapid and prospects are fair.

EVART, MICH.—The Citizens' Telephone Company has eight stations and 45 miles of copper toll line from Marion to Farwell, via Evart. Mr. C. E. Bell, the secretary, favors us with the above information.

CARROLLTON, ILL.—Mr. Halleday, manager of the Illinois Telephone Company, informs us that it operates a 100-drop board and has 76 subscribers. Country lines are projected and the outlook is very bright.

DODGE CITY, KAN.—The Dodge City Telephone Exchange operates National Automatic apparatus, has switchboard capacity of 100 drops and 75 subscribers. An increase of 20 telephones is projected.

FALLS CHURCH, VA.—The Falls Church Telegraph & Telephone Company operates a 100-drop board, with 50 subscribers, and has Southern Bell apparatus. A large increase of subscribers is expected in the near future.

PHILANTHROPY, OHIO.—The Butler County Western Telephone Company has only recently commenced operations, but will extend its service over a great part of Butler County. It has a 25-drop board and 50 subscribers.

CYNTHIANA, KY.—The Cynthiana Telephone Company, which has American Electric apparatus, operates a 300-drop board and has 231 subscribers. Toll lines over every road in the county are projected, and the outlook is good.

ALLIANCE, OHIO.—The Central Union Telephone Company (Bell) employs Western Electric apparatus and has a 350-drop board with 445 subscribers. It had a gain of 200 in the last seven months and expects to do better this year.

OSWEGO, KAN.—Mr. E. B. Morgan, manager of the Oswego Telephone Company, informs us that the company has a switchboard capacity of 100 drops and 93 subscribers. The American Electric Telephone Company's apparatus is used.

PATTONSBURY, MO.—Mr. J. S. Adams advises us that the maker of his apparatus is the American Electric Company, that he operates a 75-drop board and has 63 subscribers. He has also 45 miles of toll line and expects to build farmers' lines.

ALEDO, ILL.—The Aledo Telephone Exchange Company has a 400-drop board, with 320 instruments installed. Western Telephone Construction apparatus is used. The company has over 300 subscribers. Some cable work is projected.

OAKVILLE, IA.—The Oakville Telephone Company has a Eureka board of 100 drops and is using Swedish-American bridging apparatus. It has 150 subscribers and expects to double that number within the next 12 months. Mr. F. C. Edwards is secretary.

EDINBURG, IND.—The Citizens' Telephone Company informs us, through its manager, Mr. A. W. Winterberg, that it operates two switchboards of 100 drops each, and has 185 subscribers, with a large expected increase. The outlook could not be better.

MULDROW, I. T.—The J. W. Bindlove Long Distance Telephone Company uses apparatus of the Bell Telephone Company and a 25-drop board. Last year 45 miles of wire were put up and this year more will probably be built. The service is in fine condition.

TIFFIN, OHIO.—The Home Telephone Company, using American Electric Telephone Company apparatus, has a 780-drop board and 815 subscribers, of whom 143 were added last year. Mr. Briggs informs us that it expects to put in many additional farmers' lines.

DENNISON, OHIO.—The Uhrichsville & Dennison Home Telephone Company, which began business in September, 1900, has two boards of 300 drops each and has 425 subscribers. A very large increase is expected. The apparatus used is of American Electric Company make.

FRANKLINVILLE, N. Y.—We are informed by Mr. Y. W. Ferris, of the Franklinville Telephone Company, that consolidation with some six or eight nearby towns, with $50,000 capital, is projected. The company uses Eureka apparatus, has a 19-drop board and 165 subscribers.

MOUNT HOLLY, N. J.—The Burlington County Telephone Company operates a 400-drop board and has 300 subscribers and the number is steadily increasing. It is putting in new telephones all the time and has a busy season in view. It uses American Electric and Western apparatus.

SHEFFIELD, ALA.—The Southern Bell Telephone Company projects a new exchange building here. It has a 100-drop board and 118 subscribers. The service has been much improved between Sheffield, Tuscumbia and Florence.

GREENWICH, MICH.—We are indebted for the following items to the manager of the Greenwich Telephone Company, Mr. W. B. Serviss: Eureka Electric apparatus is used, a 300-drop board with 255 subscribers. Increase was rapid last year and prospects are good for the same this year.

RAVENNA, OHIO.—Eureka Electric apparatus is used by the Ravenna Home Telephone Company, which operates a 300-drop board and has 325 subscribers. A 500-drop board is projected to meet growing demands. Business is fine, dividends of 6 per cent being paid, and the outlook could not be better.

CHARLESTON, ILL.—The Charleston Telephone Company informs us, through the proprietors, Messrs. Brooks & Cadle, that its apparatus is of Western Telephone Construction Company and Sterling make; it operates a 325-drop board and has 300 subscribers. Additions are projected and prospects are very bright.

FLEMINGTON, N. J.—We are indebted to Mr. A. B. Reading, owner of the local telephone exchange, for the information given herewith. He operates a 50-drop metallic board and 50 party lines. A new line to Cherryville has been built and others, to several small towns, are projected. Phœnix Electric apparatus is used.

VANDALIA, MO.—The Vandalia & Hutchison Telephone Company has a switchboard capacity of 100 drops and operates apparatus of the Mexico Telephone Company, of Mexico, Mo. It has 60 subscribers and several waiting for telephones. Some party lines are projected and the outlook for country lines is favorable.

BELL PLAIN, N. J.—The Enterprise Telegraph & Telephone Company operates a 200-drop board at Millville, 100 at Ocean City, 50 at Egg Harbor and at other places. It has 500 subscribers and has recently built toll lines to Egg Harbor and elsewhere. Novelty Company apparatus is used. Many extensions are contemplated.

GRAND RAPIDS, MICH.—Mr. J. Brown, secretary of the Citizens' Telephone Company, furnishes us with a few items of interest. The company uses American Electric Telephone Manufacturing Company apparatus and has 3485 telephones. There was a large increase last year and a large one is looked for during the present one.

NORSELAND, MINN.—The Nicollet County Telephone & Telegraph Company is operating a double metallic toll line with nine stations, a total length of 36 miles. Each of the toll stations will eventually be made a central station, and a telephone will be placed in every farm house along the line. Mr. H. A. Burke is secretary of the company.

NORRIDGEWOCK, MAINE.—Mr. O. F. Hall, of the New Sharon & Norridgewock Telephone Company, informs us that its apparatus is of the make of the Couch & Seeley, Connecticut Telephone Company and Viaduct Manufacturing Company. It operates a 12-drop board and has 35 subscribers. More line and instruments will be put in to meet a growing demand.

CANYON CITY, ORE.—The Pacific States Telephone & Telegraph Company has an exchange here with a capacity of 40 lines, using Western Electric Company apparatus. It has 24 subscribers and 19 additional ones already contracted for. The business outlook for the company is good, especially for the toll line service. The exchange was established in July of last year.

ST. JOHNSBURY, VT.—We are indebted to Mr. G. W. Buzzell, president of the Citizens' Telephone & Telegraph Exchange, for a very interesting account of his successful undertaking. Commencing in a very small way in 1900, he has now a fine central office with Couch & Seeley Company apparatus, a 450-drop board and 400 subscribers. The outlook is very bright, indeed.

NEW HAVEN, IND.—Mr. D. H. F. Berberich, an officer of the New Haven Home Telephone Company, furnishes us with the following: Its apparatus is of American Electric Telephone Co. make, and it operates a 100-drop board, with 35 subscribers. Several miles of toll line have been recently put up and more are projected, with an increase of telephones. The prospects are excellent.

VALLEY FALLS, KANS.—Mr. J. A. Zimmerman, owner of the Valley Falls and Baldwin telephone companies, informs us that he uses apparatus of the American Electric and Western Electric Supply Company makes. His switchboards are of 100-drop capacity each and he has 100 subscribers at Valley Falls and 90 at Baldwin. Toll lines to various places are contemplated, and the outlook is good.

MALONE, N. Y.—The Racket River Telephone Company, of Potsdam, and the Franklin County Telephone Company, of Malone, are owned by Messrs. Ferensen and Crawford, of Hamden, N. Y. The former uses American Electric apparatus, the latter Stromberg-Carlson. Both are in good shape and report bright outlooks. While both have 200-drop board capacity, the Racket River has 200 subscribers, the Franklin 180.

MANHATTAN, KAN.—The Wareham & Wood Telephone Company of this city and the Wareham-Dewey Telephone Company of Junction City and Fort Riley, Kan., are jointly operating a system including 300 subscribers at Junction City and Fort Riley, and 350 in Manhattan. The Junction City system is a new plant, recently installed, and is rapidly growing. It is expected that 500 subscribers will be obtained there. Sterling apparatus is used in both towns. Mr. H. P. Wareham is manager.

ELMORE, OHIO.—Through the courtesy of Mr. J. G. Steinkamp, of the Elmore Home Telephone Company, we are in possession of the following: This is part of the system of the Ottawa County Telephone Company, with an exchange at Oak Harbor and nearly 100 subscribers. It also owns a system of toll lines connecting 12 towns and is building an exchange at Woodville with over 70 subscribers, and projects more toll lines. It uses North telephones. There is a 100-drop board here and 73 subscribers. This plant is newly opened. It has Kellogg apparatus.

TELEPHONE NEWS.—(Continued.)

PEKIN, ILL.—The Pekin Telephone Company has built 90 miles of toll line.

KINEO, MAINE.—The Kineo & Northeast Carry Telephone & Telegraph Company has 10 offices from Kineo to Chesuncook.

FLORA, ILL.—Mr. S. J. Friend kindly informs us that he operates a 200-drop board and has 165 subscribers. The outlook is good.

WABASHA, MINN.—The Wabasha Telephone Company has a 100-drop board and 100 subscribers. The prospects for business are good.

MONTICELLO, N. Y.—The Monticello Telephone Company has a 100-drop board and 20 subscribers. It is just commencing business.

SMITHLAND, IND.—The Smithland Telephone Company informs us that prospects are good. With a 65-drop board it has 55 subscribers.

WEATHERBY, MO.—The Weatherby Telephone Company has a 30-drop board and 40 subscribers. A line to Cameron is projected and the outlook is very good.

OTISCO, N. Y.—The Otisco & Cedarville Telephone Company sends a report of excellent business and prospects. The toll line has only been in operation a few weeks.

MORENCI, MICH.—The Morenci Telephone Company is in excellent condition, has a 130-drop board and 141 subscribers. A large increase is expected in the near future.

NORTH CONWAY, N. H.—The North Conway Telephone Company has a 25-drop board and 27 subscribers. A large increase of business is expected during the summer.

SOUTH WHITLEY, IND.—The South Whitley Telephone Company has a 100-drop board and 82 telephones. It is about building a 22-mile line and its prospects are good.

UNION CITY, IND.—The Union City Telephone Company operates a 300-drop board and has gained 210 subscribers in one year. Business is good and steadily increasing.

THOMASTON, GA.—The proprietor of the Thomaston Telephone Company informs us that he has 100-drop board capacity and 110 subscribers. The outlook is most encouraging.

TIPTON, IA.—The Tipton Telephone Company, which commenced business last October, has 150 subscribers and a quick and steady increase. Its switchboard capacity is 200 drops.

PALMYRA, ILL.—The Palmyra Telephone Company intends putting in several farmers' lines. It operates a 110-drop board and has 90 subscribers, with very good prospects for more.

MICHIGAN CITY, IND.—The Merchants' Mutual Telephone Company reports steady increase of business. It uses a 600-drop board and has 560 subscribers. Its prospects are excellent.

NORTHWOOD, IA.—Mr. F. C. Hall, of the Northwood Telephone Company, informs us that its prospects are good for a steady increase. It operates a 100-drop board and has 92 subscribers.

CHAMPAIGN AND URBANA, ILL.—The Home Telephone Company has a drop board capacity of 700 and 640 subscribers, many being of recent addition. It is now getting in 40 and 50 per month.

MOORESVILLE, IND.—The Mooresville Telephone Company, established but a few months ago, has made good progress. It has 95 subscribers and a 100-drop board. Continued increase is expected.

WARSAW, IND.—The Commercial Telephone Company is in fine shape. We learn from Mr. Baker, the secretary, that it operates a 200-drop board and has 165 subscribers, with a steadily increasing list.

RIDGEVILLE IND.—The Ridgeville Telephone Company operates a 100-drop board and has 6 subscribers, it having but recently commenced business. Toll lines are to be built to some six or eight places.

BROCTON, ILL.—The Hume Telephone Company has a 120-drop board at Hume and a 100 at Brocton. Hume has 100 subscribers, Brocton 43. The prospects are good and they expect to fill both boards this year.

PLATTE CITY, MO.—Messrs. Wall & McBeath, who have just taken possession of the telephone exchange, report very favorably on the outlook. They have an American Express board of 100 drops and 74 subscribers.

CHERUBUSCO, IND.—The Cherubusco Telephone Company has only been in operation six months, but finds prospects good and expects to build several toll lines. A 100-drop board is used, and there are 92 subscribers.

MARLBORO, N. Y.—The Marlboro & Milton Telephone Company informs us, through Mr. H. C. Cooley, that it has just been organized and is merely a local line. It uses two centrals, 10 drops each, and has 13 subscribers.

KINGMAN, IND.—The Millcreek Telephone Company has two boards, one each at Kingman and Yeddo. A new board is to be put in at the former place, and quite a large increase is projected. There are 60 subscribers.

ALBANY, OHIO.—The Albany & Vales Mill & Athens County Telephone Company operates a 300-drop board and has 280 subscribers, many being recent additions. A large increase is expected and prospects are very good.

FORT WAYNE, IND.—The Home Telephone & Telegraph Company has made great improvements in its equipment and expects to double its business in the near future. It operates a 2500-drop board and has 2100 subscribers.

AUBURN, ILL.—Mr. H. R. Ramsey, proprietor of the Auburn Telephone Exchange, informs us that an increase in local and toll lines is projected. Growth has been very rapid. It operates a 200-drop board and has 115 subscribers.

NAPPANEE, IND.—We are informed by Mr. Stoops, of the Nappanee Telephone Company, that the outlook is excellent. Its switchboard capacity is 200 drops and it has 108 subscribers. Country lines are to be built in the spring.

SEYMOUR, IA.—The Seymour Telephone Company operates a 150-drop board with 212 subscribers. Last year 95 telephones were added and as many more are expected this year. The farmers use party lines of from 1 to 20 on a line.

CHADWICK, ILL.—The Carroll County Telephone Company informs us, through Mr. Frank Zinnel, the proprietor, that the outlook is very bright. It uses a 500-drop board and has 500 subscribers. The number is daily increasing.

LOCKPORT, ILL.—We are indebted to the president of the People's Telephone Company for the following information: It operates a 200-drop board and has 150 subscribers. A large increase is projected and the outlook is very bright.

HUNTINGDON, TENN.—The Carroll County Telephone Company has a 200-drop board here and 100 at McKenzie. Mr. Wright, the secretary, informs us that there is a great demand for country lines. The company has 300 subscribers.

WINDSOR, MO.—The Union Telephone Company operates a 100-drop board at Windsor, one of 400 at Clinton and one of 50 at Calhoun. Altogether it has 650 subscribers and 80 miles of metallic toll line and intends building 60 miles more.

STANFORD, ILL.—Through the courtesy of Mr. W. Patch we obtain the following concerning the Patch Telephone Company: With a 100-drop board it has 106 subscribers. An exchange is to be put in at Danvers, Ill., with prospects of 300 subscribers.

PITTSTON, PA.—The People's Telephone Company, using Sterling Company apparatus, has a 300-drop board and 300 subscribers, an increase of 200 in 12 months. We are informed by Mr. Smith, the manager, that a like increase is expected this year.

ROSSVILLE, ILL.—The Rossville Telephone Company is growing steadily. It operates drop boards at all its stations and has 300 subscribers. It intends to develop territory and build a short line. We are indebted for the above to Mr. P. M. Warner, the secretary.

REED CITY, MICH.—The Reed City Telephone Exchange has a 200-drop board and 85 subscribers, with a large expected increase. We are informed by the manager, Mr. Marshall, that the maker of its apparatus is the American Electric Telephone Company.

RICHMOND, IND.—The Richmond Home Telephone Company has a 1200-drop board and 1300 subscribers. It records a growth of 270 in 12 months. Two new sections are to be added to the board. The outlook is favorable, with an increasing demand for country lines.

GLOUSTER, OHIO.—The Union Telephone Company, recently in active operation, informs us, through its secretary, Mr. Edwards, that business is good and the outlook could not be better. It has 143 subscribers and is now building to Nelsonville and intermediate points.

JOHNSTOWN, PA.—The Johnstown Telephone Company has a switchboard capacity of 1000 drops and 1200 subscribers. It is now constructing a complete underground, full metallic, central energy multiple system and erecting a fine fire-proof exchange and office building.

EVART, MICH.—Mr. C. E. Bell, proprietor of the Evart Telephone Exchange, favors us with the following interesting items: The exchange has a drop-board capacity of 100 and 60 subscribers. An increase is projected, and extensive farmers' lines will be installed soon.

CHATSWORTH, ILL.—The Peoria & Eastern Telephone Company is doing good business, having added 200 to its subscribers' list last year. These now number 520. It operates a 700-drop board, Western Electric apparatus being used. Lines for rural subscribers are projected.

NEVADA, IA.—We learn from Mr. Boardman, manager of the Nevada Mutual Telephone Company, that its switchboard capacity is 300, with 220 subscribers. Seventy miles of toll line have been recently built and two exchanges are projected. Improvements are now being carried on.

PENDLETON, IND.—We are indebted to Mr. E. D. Allen, of the Pendleton Telephone Company, for the following: Its apparatus is of the Eureka Electric Company; it has a drop board of 100 capacity and 150 subscribers, with a large expected increase. The prospect is very encouraging.

OLATHE, KAN.—The Olathe Citizens' Telephone Company, which uses Stromberg-Carlson apparatus, has a 200-drop board and 175 subscribers and a large expected increase. It has a 50-mile toll line. It recently replaced its primary cells with storage battery, and the iron wire with copper.

HANCOCK, WIS.—The Union Telephone Company, with exchanges at Hancock and Plainfield, has 200 subscribers and 8 or 10 farmers' lines, which it proposes extending considerably. The Plainfield board has 100 drops. We are indebted to the president, Mr. D. B. Borden, for this information.

LIMA, OHIO.—The manager of the Lima Telephone Company, Mr. G. H. Metheany, favors us with the following: Its switchboard capacity is 700 and the number of subscribers 690. It is now installing a 2000-line multiple switchboard and underground system, covering the business district of the city.

COLUMBUS, OHIO.—We have received the following information from Mr. A. W. Hoge, superintendent of the Columbus Citizens' Telephone Company. Its switchboard capacity is 6000 drops and it has 4600 subscribers, the number increasing at the rate of 200 per month. It has very bright prospects.

COLUMBUS, IND.—The Citizens' Telephone Company of Columbus, and the Rural Telephone Company of Clifford have been sold by Mr. Butler and are now in the hands of Mr. S. P. Sherin. They operate, respectively, 400 and 25 drop boards, and have 400 and 10 subscribers. A large increase is projected.

KEOKUK, IA.—The Mississippi Valley Telephone Company of Iowa has exchanges in Keokuk, Fort Madison, Burlington, Wapello, Columbus Junction and Muscatine, and operates boards of 2000 drops in the six places. It has 1500 subscribers and 300 are to be added. More toll lines and two exchanges are to be added to the system. Its prospects are excellent.

BOONVILLE, MO.—We are indebted to Mr. E. P. Erwin, superintendent of the Boonville Telephone Company, for the following interesting items: It uses American switchboard and telephones and Sterling heat coil and pole top terminals. Its switchboard capacity is 300 and it has 300 subscribers. A one-section 100-drop board is to be installed. The company contemplates building long-distance lines in all directions and expects a large increase in the number of subscribers.

TELEPHONE NEWS.—(Continued.)

HOWARDSTOWN, KY.—Howard Bros. operate a 15-drop board and have 15 subscribers.

GRANVILLE, ILL.—The Granville Telephone Company has about 40 subscribers and a 25-drop board.

ELMWOOD, NEB.—The Elmwood Telephone Company operates a 100-drop board and has 37 subscribers. Prospects are very good.

MURPHYSBORO, ILL.—Logan & Minton operate a 300-drop board with 250 subscribers and an increasing business. The outlook is good.

NORTON, KAN.—The Norton Telephone Company has a switchboard capacity of 100 drops and 100 subscribers. The outlook is very good.

LISBON, IA.—The Lisbon Telephone Company has a 100-drop board and 120 subscribers. Country lines are projected and prospects are good.

SAUGATUCK, MICH.—The Saugatuck & Ganges Telephone Company uses Harrison apparatus and has a 250-drop board with 147 subscribers.

COLDWATER, OHIO.—The Co-Operative Telephone Company has a 100-drop board and 38 subscribers. Extensions are projected in the near future.

WILSON, KAN.—Messrs. W. F. Zeigler & Company operate a 100-drop switchboard and have 60 subscribers. They project a line to Russel, 25 miles distant.

PONCA, NEB.—The Ponca Telephone Company is of recent formation, but Mr. E. W. Gray informs us that a boom is expected and business promises well.

DE WITT, NEB.—The De Witt Telephone Company uses party lines and has 37 instruments, which were all installed in 1900. This number will be doubled soon.

GREAT BEND, KAN.—The Grimes Bros. Electric Light & Telephone Company operates on the automatic system. It has 80 subscribers and an increase is projected.

MUNISING, MICH.—The Munising Telephone & Electric Company operates a 150-drop board and has 65 subscribers, with an expected increase. Prospects are bright.

HOPKINS, MO.—The Hopkins Telephone Company reports bright prospects. It has a drop board capacity of 100; subscribers, 94. A new switchboard is to be added soon.

NORTH SALEM, IND.—The North Salem Telephone Company has 100-drop board capacity and 100 subscribers. Recent growth has been good and prospects are favorable.

MOODY, TEX.—The Moody Telephone Company, Mr. O. R. Porterfield, manager, has a 100-drop board and 80 subscribers. The company is of recent formation and has a very economical plan for country lines, giving speical attention to farmers.

STURGION, MO.—The New Century Telephone Company operates a 100-drop board and has 227 subscribers, with a large expected increase. The prospects are exceedingly bright.

RIPLEY, N. Y.—The Ripley Telephone Company reports a good demand in the rural districts. Its apparatus is Standard make and it operates a 100-drop board with 105 subscribers.

LOCKPORT, N. Y.—The Crosby Telephone line informs us, through Mr. E. B. Crosby, that prospects are very bright. It operates a toll line and projects an extension of 10 miles.

FORNICA, ILL.—The Fornica Switchboard Company has a 100-drop cabinet, operates 50 with 70 subscribers. Steadily increasing growth will probably necessitate a larger switchboard.

NORTH CAPE, WIS.—Mr. G. Spillum, of the North Cape & Union Grove Telephone Company, informs us that it operates farm lines which have been extended considerably of late.

WATERVILLE, MINN.—The Cannon Valley Telephone Company contemplates another local exchange and has now a 250-drop board with 188 subscribers. The outlook is very promising.

SPRINGFIELD, KY.—The Washington County Telephone Company has increased its business steadily. With a 100-drop board it has 100 subscribers, and improvements are in contemplation.

EUREKA, ILL.—The Eureka Telephone Exchange Company operates apparatus of the National Automatic Telephone Company. Its switchboard capacity is 100 drops and it has 75 subscribers.

RISING SUN, IND.—Green Bros. operate exchanges at Rising Sun and Vevay. Each exchange has a 100-drop board. There are 191 subscribers, and it has 200 miles of toll and country lines, principally metallic.

GIRARD, ILL.—The Girard Telephone Company expects to build toll lines and has bright prospects. It operates Eureka Electric apparatus, has a 200-drop board and 130 subscribers, of whom 40 have recently joined.

GAULLERSBURY, IND.—The Montgomery County Telephone Company has apparatus of the Viaduct Manufacturing Company. It has a 20-drop board with 80 subscribers and good prospects of an increase in the number.

GREENVILLE, OHIO.—The Greenville Home Telephone Company sends a report of good business and a bright outlook. With a 600-drop board it has 350 subscribers and expects a rapid increase during the present year.

NASHVILLE, ARK.—The president of the Nashville Telephone Company reports business looking bright and prospects good. The company operates a 100-drop board with full number of subscribers. New lines are projected.

CHARLESTON, MO.—The Charleston & Southeast Telephone Company's system is quite extensive. Charleston has 175-drop board capacity, Bloomfield 100 and Dexter 75, and about 250 subscribers. Its prospects are very good.

LA CROSSE, WIS.—The La Crosse Telephone Company projects an increase of capacity for 2000 subscribers. It operates at present a 900-drop board and has 810 subscribers. Mr. Lohmiller reports prospects very encouraging.

GALLIPOLIS, OHIO.—We are indebted to Mr. Forrest, manager of the Gallipolis Telephone Company, for the following information: It operates a 400-drop board and has 350 subscribers. Extensions are projected in the near future.

MUNCIE, IND.—The Townhill Telephone Company is devoted exclusively to rural lines and commenced business last year. It has 61 subscribers and will build other lines in the spring. We are indebted to Mr. G. A. Ribble for the above.

NEW AUGUSTA, IND.—The New Augusta Independent Telephone Company uses apparatus of the Eureka Electric Company. It has been lately organized, has a 50-drop board and 20 subscribers. Mr. Nagle, the secretary, reports a good outlook.

ALBION, NEB.—The Albion Telephone Company, T. F. Martin, manager, has been in operation one year. It has a 200-drop board and 176 subscribers; has built a toll line to Cedar Rapids, where it has installed an exchange with 48 subscribers.

WICKLIFFE, KY.—The manager of the Wickliffe Telephone Company has kindly furnished us with the following: It uses American Electric Telephone Company apparatus, a 100-drop board and has 81 subscribers. The outlook is very good.

JEFFERSON CITY, MO.—The superintendent of the Capital Telephone Company informs us that business could not be better, as it can scarcely put in equipment fast enough. Its switchboard capacity is 400; toll board, 10. There are 400 subscribers.

BETHANY, ILL.—We are indebted to Mr. W. S. Herman for the following information regarding his telephone lines: He operates a 100-drop board with 61 subscribers and intends running country lines, the outlook for farmers' telephones being very good.

FARMLAND, IND.—The Farmland Telephone Company has a 100-drop board besides party lines, and 65 subscribers. More party lines, with from 35 to 50 subscribers, are projected. Mr. Wright, the superintendent, informs us that the outlook is excellent.

BUSHNELL, ILL.—The Bushnell Telephone Company, owned by Mr. J. Lightner, operates a 200-drop board. It has 160 subscribers in the city exchange and 150 farmers' single-ground toll lines. Recent growth has been good, and extensions are projected.

HAGERSTOWN, IND.—The Hagerstown Telephone Company operates a 100-drop board. Commencing in September, 1900, with 55 telephones, it now has 112 subscribers and contemplates building several toll and party lines. The outlook could not be better.

NEW RICHLAND, MINN.—We are indebted to Mr. H. Jarhning, proprietor of the New Richland Telephone Exchange Company, for the information given below: Prospects for the future are good. A 50-drop board is in operation and there are 56 subscribers.

ALBION, IND.—The Noble County Telephone Company is of recent formation, and extremely enterprising. With a 200-drop board it has 150 subscribers and is building several country lines. Mr. M. C. Meyer, the secretary, informs us that the outlook is very encouraging.

JACKSONVILLE, FLA.—We are indebted to Mr. W. N. Shine, president of the Jacksonville Telephone Company, for the following: His company operates a 1000-drop board and has 864 subscribers. An increase is projected, including a 1200 multiple board and underground work.

FOREST CITY, IA.—Mr. J. A. Peters, of the Winnebago Telephone Company, informs us that his system will probably be changed and improved. His switchboard capacity is 300, of which 150 drops are installed. It has 135 subscribers and the number is increasing steadily.

BERLIN, MD.—The Synepuxent Telephone Company was started in July, 1900, as a small line from Berlin to Snow Hill, but has increased rapidly and now has 50 miles of toll line. It operates a 50-drop board and has 60 subscribers. New lines to Ocean City and Liberty are projected.

TISKILUA, DEL.—The Tiskilua Telephone Exchange has been in operation little over a year but is prospering and has a fine outlook. Mr. May, the manager, has kindly furnished us with details. It has a 100-drop board and 44 subscribers, which number it expects to double this year.

RURAL RETREAT, VA.—We are indebted to Mr. J. W. Eiffert, of the Rural Retreat Telephone Company, for the following items: The company operates a 100-drop board and has 105 subscribers, with a very bright outlook. Its apparatus comes from the Telephone Manufacturing Company of Sumter, S. C.

DANVILLE, IND.—The Vermilion County Telephone Company operates at Ridgefarm, Georgetown, Catlin and Indianola, besides Danville. With 1400 capacity drop board, it has 1100 subscribers and a large expected increase. Prospects never were better, says Mr. Baum, to whom we are indebted for the above information.

PONTIAC, MICH.—The Oakland County Telephone Company has a switchboard of 300 drops and 375 subscribers. Business was started in October, 1900, and has progressed rapidly. It has toll lines to all points in the county and to Detroit and several other cities. We are indebted to Mr. C. S. Bartlett for this information.

COLUMBUS CITY, IND.—We are indebted to the president of the Home Telephone Company for information concerning its business. It operates a 200-drop board and has 189 subscribers. An additional board of 100 capacity is projected and more toll lines. At present it has about 260 miles, reaching all parts of the county.

NEWTON, KAN.—Mr. A. R. Champlin, proprietor of the Newton Telephone Company, kindly sends us the following: Its apparatus is from the American Electric Telephone Company and it operates a 400-drop board with 330 subscribers. It has recently installed 30 miles of toll line and contemplates 30 miles more, into Wichita, Kan.

BATAVIA, OHIO.—The Batavia Telephone Company uses Swedish-American apparatus and has a 100-drop board with 50 subscribers. It commenced operations with the new century and has very good prospects. An exchange at Milford is ready to open with 50 subscribers, and it will build to Loveland, Amelia, New Richmond, Moscow and several other places. We are indebted to Mr. W. H. Baum for the above.

TELEPHONE NEWS.—(Concluded.)

LAVARAT, MO.—The Lavarat Telephone Company has switchboard capacity of 550, and 600 subscribers. Prospects are very good.

GIRARD, GA.—The Girard Telephone Company has 20 subscribers and a switchboard capacity of 25 drops. Mr. W. R. Buxton is secretary and treasurer of the company.

DEER CREEK, ILL.—Messrs. Davis & Son are operating an exchange in this place with a capacity of 100 drops, having 90 subscribers. They expect to double the number during the year. Mr. D. I. Davis is secretary of the company.

PRESCOTT, ARK.—The Southwest Arkansas Telephone Company has 82 subscribers and a switchboard capacity of 100. Eighteen of its subscribers are of recent addition, and it is expected that the limit of the board will soon be reached.

CHELSEA, MICH.—The Chelsea Telephone Company is contemplating the building of a number of farmers' lines. At present it has a switchboard capacity of 100 drops and 84 subscribers. It uses the apparatus of the Victor Telephone Company. L. L. Gordon is president.

MAYFIELD, KY.—The West Kentucky Telephone Company is operating exchanges at Mayfield and Fulton, with switchboard capacity at each place of 200 drops. There are 200 subscribers in each town and 100 more are expected to be added during the next year. Mr. J. E. Wright is manager. He reports a good outlook for business.

BEMIDJI, MINN.—The Bemidji Telephone Exchange Company has a switchboard capacity of 150 drops, the apparatus being of the Minnesota Electric Company's make. The company has 102 subscribers and began business on Sept. 20, 1900. Mr. J. H. Haner, president of the company, states that business is flourishing, the outlook excellent and that an increase of 30 per cent is projected.

FREEPORT, L. I.—The South Shore Telephone Company has 400 subscribers and is using Phœnix Electric and Sterling apparatus. The lines were recently extended to Sea Cliff and Roslyn, and the extensions will be carried westward toward Jamaica; also eastward. In spite of the strong Bell opposition the company is reported to be a great success and paying 6 per cent dividends.

WINCHESTER, ILL.—Mr. Geo. E. Woodhead is operating an exchange in this place with a switchboard capacity of 135 drops. Toll and country lines are on jacks through the exchange. He has 151 subscribers and uses the apparatus of the Monarch Telephone Company, Palmyra, Ill. Mr. Woodhead started business in 1898 with 73 subscribers and the growth has been steady ever since. He expects to add 12 more town subscribers to his list and will extend his lines to reach 50 new subscribers in the suburbs and on toll lines. The extensions will be about 40 miles in length. Mr. Woodhead reports a very encouraging outlook. He is charging $1 for residence instruments and $1.50 for business.

JEFFERSON, IA.—The Jefferson Telephone Company is operating two exchanges, one at Jefferson with a 200-drop board, and one at Grand Junction, Ia., with 100 drops, using the apparatus of the American Electric Telephone Company. The total number of subscribers is 300. The Grand Junction exchange was recently burned to the ground, the fire also destroying the terminal poles, etc. If nothing prevents, the company expects to get it in operation again by March 1 next. The outlook for business is very bright. Mr. Chas. G. Cockerill, president of the company, states that the farmer lines are going to be an important part of the business, which is growing very fast, and the company is compelled to take care of it.

WATERLOO, MICH.—The Rural Telephone Company has 160 subscribers and uses the Williams-Abbot Electric Company apparatus. This number of subscribers is divided among 20 lines. The company has 200 miles of lines and it reaches 21 towns and villages in this section. The subscribers have free service with one another and with the Chelsea Telephone Company and the Mason Telephone Company. Mr. Lyman L. Gordon is secretary of the company. Its lines also connect with other farmers' lines, thus giving connection with 300 other subscribers on payment of a toll of 10 cents per message. The company will, in the spring, complete lines to Howell, Williamstown and Jackson. Besides operating country lines the Rural Company has exchanges at Stockbridge and Gregory, besides Waterloo.

General News.

ELECTRIC LIGHT AND POWER.

ARCHBOLD, OHIO.—The village authorities are investigating the cost of a municipal lighting plant.

WHITEHALL, WIS.—The electric lighting plant is shut down on account of the washing out of the dam.

RIPON, WIS.—Bids are asked until March 5 for a franchise for an electric plant for the city for from 5 to 15 years. F. W. Allen is the City Clerk.

VINCENNES, IND.—E. J. Julian, manager of the Vincennes Electric Light Company, has been appointed receiver thereof by the Circuit Court.

HAMILTON, OHIO.—The Hamilton Corliss Engine Works have purchased two 40-hp motors, direct connected to Fort Wayne 40-light arc machines.

CLEVELAND, OHIO.—School Director Bell has announced that electric lights will be installed in all public school buildings. Gas is now used in the majority of the buildings.

INDEPENDENCE, MO.—It is reported that the gas and electric lighting interests of this place are to be consolidated. Mr. C. H. Hammett, of Kansas City, is promoting the consolidation.

CAMBRIDGE, OHIO.—The Cambridge Electric Energy Company, reorganized as the Cambridge Ice & Electric Company, has added a 150-kw low frequency alternator, sold by the Fort Wayne Electric Works.

BUCYRUS, OHIO.—Peter Young, of Mt. Vernon, Ohio, and Isaac Baxter, of Detroit, Mich., have bought out the plants of the Bucyrus Electric Light Company and the Bucyrus Gas Company. The companies are capitalized at $70,000.

RICHMOND, IND.—The citizens have brought further injunction proceedings and amended complaint against the city to prevent the erecting of a municipal electric light plant. They allege that the indebtednes will exceed the constitutional limit.

JERSEY CITY, N. J.—The Sussex Light & Power Company has been incorported with a capital stock of $500,000. Incorporators: Franklin J. Myers, R. H. Batchelor, Alex. T. Rice, Wm. Duncan and Wm. J. Schneider. The principal office of the company is in this city.

COLUMBUS, OHIO.—A resolution has been introduced in the City Council directing the committee on gas and electricity and the director of public improvements to prepare and report a plan and detailed estimate of the cost of an electric light plant, complete, for city use.

GRAND RAPIDS, WIS.—At a meeting of the stockholders of the Twin City Electric Company it was decided to change the name to "The Electric & Water Company" and double the capital stock, making it $40,000; also not to declare a dividend of more than 12 per cent in the future.

JEFFERSONVILLE, IND.—The engineer and employees of the electric light works of this city banked the fires, shut down the machinery and locked up the place, stopping the entire service and throwing the city into darkness with the view of enforcing the payment of their wages, which were back for seven weeks.

ALLIANCE, OHIO.—A Council committee, appointed to investigate the probable cost of operating a municipal lighting plant, has returned a report that a suitable plant would cost $35,000. It recommended that it would be more economical to renew the contract with the Alliance Gas & Electric Company, which will probably be done.

CHARLOTTE, N. C.—It is announced that the Cape Fear Power Company, which proposed to develop the falls of the Buckhorn on Cape Fear River, near Fayetteville, N. C., has succeeded in placing itself on a sound financial basis and will be able in the near future to furnish electric power to Fayetteville, N. C. W. M. Morgan is one of the chief promoters.

SAN FRANCISCO, CALIF.—The Bay Counties Power Company has about completed one pole line from the power house on the Yuba River to Vallejo, Calif. The line now extends to tidewater near Suisun. Electric power, to fill contracts in Vallejo, may be supplied during the present month. Work is in progress on the two spans of 4700 ft. each at a height of 400 ft. over Carquinez Straits.

MENASHA, WIS.—This city is much agitated over the prospects of possible municipal ownership in a water works and electric light station. A franchise for a water works and electric light station has been granted to Y. P. Miller & Company, of Chicago. The plan is for the company to erect a $60,000 plant, to be paid for by the city on the installment plan. Thirty-seven arc lamps are called for in the contract.

DENVER, COLO.—The Denver Gas & Electric Company has offered to supply to the city for a period of 1, 3, 5 or 10 years, 1000 2000-cp arc lights for all night and every night service at $60 per year per lamp. It also offers, if the proposition to the city is accepted, to charge private consumers on the average less than 10 cents per kilowatt-hour for incandescent lighting and less than 4 cents per kilowatt-hour for current for power purposes.

CALIFORNIA POWER.—A dispatch from San Francisco of Feb. 15 says: "The electric transmission line from the immense plant in the mountains of Calaveras County was completed to San Jose to-day, and preparations are complete to furnish light and power to the surrounding country. The value of manufacturing interests will be greatly enhanced by this power installation. New factories are contemplated, and the street railways of San Jose will use the current."

SAN FRANCISCO, CALIF.—The San Francisco Gas & Electric Company, under an order from the Board of Supervisors, recently filed a statement showing the cost of producing gas and electricity during the past year. The receipts from the sale of gas and its by-products were $1,335,069.73; cost of production, $913,-151.25. Receipts from sale of electricity, approximately, $781,205.57; cost of generating the same, $575,006.51. Net profits, $628,717.54; dividends paid, $516,717.96; bond interest, $37,380; surplus, $74,019.58.

OTTAWA, ONT.—The annual meeting of the Cataract Power Company, of Hamilton, Ont., was held on Feb. 11. The gross receipts of the company, including the Electric Street Railway, the Hamilton & Dundas Railway and the Radial Railway, were $421,311. After payment of operating expenses, interest on bonds, franchises, taxes, etc., as well as two dividends on the preferential cumulative stock, a balance of $29,689 remained at the credit of profit and loss. Hon. J. M. Gibson is president, John Moodie treasurer and John Patterson secretary.

SAN FRANCISCO, CALIF.—The new Cedar River water system is now ready to supply Seattle, Wash., with water. Several pumping stations and reservoirs of the old system will be abandoned. The Lake Washington station, however, may be used as a municipal lighting station, in case such a plant is decided upon. The plan, which is now under consideration, is to install a number of water wheels and generators at the Lake Washington station and operate them by surplus water from the Cedar River system. There would be quite a high working head at the level of Lake Washington.

VICKSBURG, MISS.—The Board of Aldermen on May 15, 1899, contracted with the Vicksburg Railroad & Power Company to furnish 125 street lights for 10 years at $100 a year each on a moonlight schedule, which contract was contested by two large tax payers and the lighting company enjoined. The case was tried and a verdict was rendered in favor of the company. An appeal was taken to the Supreme Court and the verdict sustained. On Jan. 28 four members of the board, a majority of those present, voted to annul the contract. Feb. 1 the Chancellor issued an injunction restraining the city from further action. Another long legal battle will now be fought.

THE ELECTRIC RAILWAY.

MATTOON, ILL.—Edgar County capitalists will construct an electric railway from Paris, Ill., to Clinton, Ind.

ELYRIA, OHIO.—George Chamberlain is securing right of way for an electric railway from Elyria to Grafton.

SANDUSKY, OHIO.—A new line to extend from Clyde to Sandusky by the way of Castalia is being promoted here.

SCHENECTADY, N. Y.—The capital stock of the Schenectady Railway Company will be increased from $300,000 to $1,000,000.

INDIANAPOLIS, IND.—A bill has been introduced in the Indiana Legislature to make it unlawful for any street car to have running boards.

SANDUSKY, OHIO.—The Lake County Commissioners have granted a 25-year franchise to the Cleveland, Elyria & Western Electric Railway.

OTTAWA, OHIO.—Local citizens are trying to interest capital in an electric railway to connect Ottawa with Delphos, Defiance, Findlay and Lima.

AKRON, OHIO.—The Northern Ohio Traction Company is making surveys to extend its new Barberton line to Turkeyfoot Lake, a summer resort.

OTTAWA, ONT.—The Niagara Falls, Wesley Park & Clifton Tramway Company has appointed a committee to arrange for the construction of the road.

TROY, OHIO.—Work of erecting the power house and car barns of the Dayton, Tippecanoe & Troy Electric Railway has been started at Tippecanoe City.

NEW HAVEN, CONN.—It is announced that the Pittsfield (Mass.) Street Railway Company will extend its line southward to Lenox and thence to Lee.

SOUTH BEND, IND.—The Indiana Street Railroad Company has decided to make some extensive improvements and extensions, on which work will begin at once.

CLEVELAND, OHIO.—The Northern Ohio Traction Company is looking over the field with a view to securing a private right of way into the centre of this city.

YOUNGSTOWN, OHIO.—The officials of the Mahoning Valley Railway Company are considering the advisability of extending their line from Warren to Ravenna.

DILLSBORO, IND.—It is reported that the Big Four Railroad is trying to buy the Aurora Pike with a view of building an electric road from Aurora to North Vernon.

ELIZABETH, N. J.—The Elizabeth, Plainfield & Central Jersey Traction Company will extend its system from Plainfield to Watchung and through the Passaic Valley to Stirling.

JERSEY CITY, N. J.—The Union Traction Company has been incorporated; capital, $500,000. Incorporators: Moses M. Broadwell, Frank E. Baker, H. C. Balcom, Leonard J. Burtis.

UPPER SANDUSKY, OHIO.—Dr. G. W. Kemp has secured right of way for a road from Kenton to Upper Sandusky and is negotiating with Eastern capitalists to build the road.

HUNTINGTON, IND.—Chief Engineer Moran, of the Fort Wayne & Southwestern Traction Company, is now engaged in locating the company's power plant, barns and shops in this city.

PAINESVILLE, OHIO.—The Lake County Commissioners have granted a franchise to the Cleveland, Painesville & Eastern Electric Railway to build a branch line to Fairport on the lake shore.

TOLEDO, OHIO.—The County Commissioners have granted a 25-year franchise to John Kumler, promoter of the Toledo, Napoleon & Defiance Electric Railway, which was recently incorporated.

ALBANY, N. Y.—A bill has been introduced in the Senate providing that street surface railway companies whose lines extend a mile beyond the limits of cities and villages shall have vestibuled cars.

CHICAGO, ILL.—The Chicago Heights Street Railway Company has been organized with a capital stock of $100,000. The incorporators are Major McGregor, F. E. Von Ammon and A. H. Pugh.

DANVILLE, IND.—The Commissioners of this county have reported favorably on the petition of Fairbanks and others for a franchise through this county for an electric railway from Indianapolis to North Salem.

NORRISTOWN, PA.—The Schuylkill Valley Traction Company has elected these officers: President, John A. Rigg, of Reading; vice-president, Henry C. Moore, Trenton; secretary and treasurer, M. C. Aulenbach, Reading.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company will, it is stated, expend about $500,000 in extending and improving its system. The line now operated by steam will be operated by electric power. The entire system will be rebuilt.

GREENWOOD, IND.—At a recent meeting of the directors of the Indianapolis, Greenwood & Franklin Electric Railway Company the following officers were elected: President, W. G. Irwin; vice-president, C. F. Coffin; H. T. Miller, secretary and treasurer.

KANSAS, CITY, MO.—The cable power house of the Metropolitan Street Railway Company, at Ninth and Washington Streets, in this city, was destroyed by fire recently. The loss is placed at $75,000. Sixty cars and 1200 gallons of kerosene were destroyed.

BOSTON, MASS.—The Selectmen of Southborough have voted to extend the time of completion of the Southborough link of the Boston & Worcester Street Railway to Jan. 1, 1902. This line will form one more link in the system of through electric service between Boston & Worcester.

TOLEDO, OHIO.—J. L. Stratton of Toledo is securing right of way for a road to extend from Swanton, Wauseon and Archibold to Toledo. It will be called the Toledo, Swanton & Wauseon Electric Railway, and it will be incorporated within the near future with $600,000 capital stock.

OTTAWA, ONT.—Application will be made to the Ontario Legislature by the Ontario Colonization Railway Company for a charter to construct and operate a railway through the Parry Sound and Nipissing districts from Georgian Bay, with the privilege as to choice of motive power, either steam or electricity.

PITTSBURG, PA.—The Tarentum Traction Company has let the contract for the erection of a new car barn and several other improvements of the road. The project is also under advisement of connecting the line with one of the Pittsburg traction lines. The distance from Tarentum to Pittsburg is 28 miles.

COLUMBUS, OHIO.—The State Canal Commission has decided to refuse to make leases of canal banks for electric railway use until the State Legislature has made the law on the subject more definite and certain. This will not affect the experiments being made by T. N. Fordyce on the electric propulsion of canalboats.

CINCINNATI, OHIO.—It is stated that the Ohio Southern Traction Company has purchased the right of way of the Cincinnati & Northwestern Railroad, an abandoned steam road, which will enable it to operate its cars almost to the centre of Cincinnati. It is said that the price paid for the property was $100,000.

NORRISTOWN, PA.—The Lansdale & Norristown Electric Railway Company has been organized with a capital stock of $60,000. The stockholders are George H. Young, Bethlehem; George Hallman, Lower Nazareth; A. T. Groman, Easton; S. S. Emery and E. A. Bilheimer, of Butztown. Mr. Emery is president.

WHITE PLAINS, N. Y.—A company is being organized here to build a trolley line from here to Kensico Station on the New York & Harlem Railroad, about three miles above this village. The projectors also intend purchasing a tract of land between Washington's Headquarters and Kensico, upon which to establish a summer resort park.

KANSAS CITY, MO.—The Kansas City & St. Joseph Electric Railroad Company, whose organization was recently noted in these columns, has so far progressed with its plans that it is now ready to receive bids on the work of constructing its line. About 45 miles of track will be laid. Seventy-pound T-rails will be used in the work.

CLEVELAND, OHIO.—Henry A. Everett is authority for the prediction that in the near future the Lorain & Cleveland Electric Railway and the Sandusky & Interurban Electric Railway will be consolidated under one management and through cars operated from Cleveland to Sandusky. The two systems are practically owned by the same people.

HAMILTON, ONT.—At the annual meetings of the three electric railway lines, controlled by the Cataract Power Company of Hamilton, Ont., good showings were made in connection with each company. The reports of each of the lines disclosed a substantial surplus over the operating expenses, fixed charges, and the 5 per cent dividend that was declared.

BOSTON, MASS.—It was reported recently that the N. Y., N. H. & H. R. R. Company had practically decided to install the third-rail system on the Boston and suburban lines. President Hall and First Vice-President Merrill, however, deny that any immediate plans of the character are contemplated, and that the entire matter stands exactly where it was six months ago.

CHICAGO, ILL.—An ordinance has been introduced in the Council to amend the franchise of the Northwestern Elevated Railway Company so that instead of building an elevated structure to the city limits, as required by the present statute, it may construct an incline at Wilson Avenue and thence run surface cars by the trolley system north or norwesterly to the city limits.

WORCESTER, MASS.—A plan is being considered for the liquidation of the Worcester Traction Company of New Jersey, which owns the Worcester Consolidated Street Railway Company of Massachusetts. Owing to the difficulties of managing the property through a foreign corporation, it is proposed to revert to the older and local charter, doing away entirely with the New Jersey corporation.

YOUNGSTOWN, OHIO.—The stockholders of the Youngstown Park & Falls Street Railway Company have elected the following officers: President, Samuel C. Greir; vice-president, Joseph Hastings; secretary and treasurer, Charles W. Dahlinger. Directors, the above, with W. H. Park, H. G. Hamilton, Robert McAfee and John R. Murphy. A resolution to double track the Market Street line was voted down.

WATERVILLE, OHIO.—The Council recently called for bids to settle a fight for a franchise made by rival lines. The Toledo, Waterville & Western offered to give six tickets for 25 cents for adults and six tickets for 15 cents for children under 10 years of age; rate to Toledo, 30 cents, and round trip 50 cents. The Toledo, Napoleon & Defiance Railway Company offered to carry passengers free of charge within the city limits. Both companies gave bond of $2,500.

CLEVELAND, OHIO.—The Cleveland City Railway Employees' Association has agreed to support the Farley franchise extension ordinance providing the company will agree to pay its motormen and conductors 22 cents an hour instead of 20 cents, and to shorten the hours of labor for the motormen. The association, which numbers 600 men, is against low fares, as the members claim they would tend to decrease the wages of employees. The company thinks favorably of the proposition.

BOSTON, MASS.—It is understood here that by a new arrangement all the street railways south of Boston owned by the Massachusetts electric companies are to come under one management and be known under the title of the Old Colony Street Railway. Robert S. Goff of Fall River will be the general superintendent. Ex-President John Graham of the Quincy & Boston Street Railway has been elected vice-president. The consolidation of the system is in the line of better service and reduced fares.

TOLEDO, OHIO.—At the meeting of the stockholders of the Toledo & Western Electric Railway Company, held a few days ago, the following officers were elected: Luther Allen, president; J. R. Seagrave, vice-president; F. E. Seagrave, secretary-treasurer. The above, with Judge J. M. Stone, F. C. McMillen and C. E. French of Cleveland and L. H. Clendenin of Metamora, constitute the board of directors. The roadbed work has been completed and track laying will be commenced in a few days. Machinery is being placed in the power house at Sylvania.

SPRINGFIELD, OHIO.—The Springfield Street Railway Company has decided on a number of improvements.

WATERVILLE, OHIO.—The Toledo, Napoleon & Defiance Railway Company has secured a franchise through Waterville.

DELAWARE, OHIO.—The Delaware County Commissioners have granted a 25-year franchise to the Union Railway Company.

CLEVELAND, OHIO.—The owners of the Chagrin Falls & Eastern Railway Company are securing right of way for an extension.

CHARLOTTE, N. C.—The electric line of the Spartanburg (S. C.) Electric Railway, Gas & Power Company will be extended to Converse, S. C.

CRESTLINE, OHIO.—L. M. Coe and F. D. Carpenter, of Cleveland, are securing right of way for a road to extend from Mansfield to Crestline and Galion.

COLUMBUS, OHIO.—The Worthington, Clintonville & Columbus Street Railway Company has decided to extend its road north to Delaware and Marion with branch lines.

COLUMBUS, OHIO.—The long controversy over the street railway franchises was settled on Feb. 5 by the Council granting a 25-year blanket franchise to the Columbus Railway Company.

RAVENNA, OHIO.—The Northern Ohio Traction Company, which is securing right of way to extend its road from Kent to Ravenna, is also figuring on a line from Ravenna to Alliance.

EAST LIVERPOOL, OHIO.—The Columbiana County Commissioners have granted a franchise to Hait & Smith of Cleveland, promoters of the Salem, Lisbon & East Liverpool Electric Railway.

TIFFIN, OHIO.—The owners of the Tiffin Electric Railway & Power Company, backed by Chicago capitalists, are planning to build a road from Tiffin to Fremont, Port Clinton, Lakeside and Catawba Island.

DAYTON, OHIO.—The stokholders of the Dayton & Northern Traction Company will meet on Feb. 23 to decide on a proposition to float bonds to the amount of $450,000 to enable it to complete the construction and equipment of the road.

NORWALK, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company has perfected traffic arrangements with the Sandusky, Norwalk & Southern Railway Company so that its cars may be operated into Norwalk over the latter's tracks.

AKRON, OHIO.—The deal whereby the lines of the Akron & Cuyahoga Falls Rapid Transit Company became the property of the Northern Ohio Traction Company was closed on Feb. 1 and the property was turned over on the following day. The price paid for the lines is said to have been $480,000.

NORWALK, OHIO.—The Sandusky, Norwalk & Southern Railway Company has asked the County Commissioners for a franchise over a new route near Norwalk which will enable it to shorten its line and avoid a long grade. The road is to be rebuilt with heavy rails, and several large cars are to be ordered.

TOLEDO, OHIO.—Mr. Thomas H. McLean, vice-president and general manager of the Toledo Traction Company, on his return to his office, after his recent trip, was presented with a magnificent office chair of antique oak and Russia leather, by the conductors and motormen employed by the Toledo Traction Company.

SPRINGFIELD, OHIO.—The Springfield & Western Railroad Company, of Springfield, has been incorporated with $100,000 capital stock by Jonathan S. Harshman, James F. Mahoney, Frederick J. Green, Charles A. Ackerman and John G. Webb. It proposes to build an electric road from Springfield to New Carlisle.

CLEVELAND, OHIO.—The formal organization of the Cleveland & Southern Electric Railway Company has been effected, with W. H. Lamprecht president, A. H. Pomeroy vice-president and F. T. Pomeroy secretary and treasurer. The directors include the above, with A. E. Aikins, L. J. Wolf, F. T. Fuller, U. G. Walker and F. H. Ginn.

SPRINGFIELD, OHIO.—The Dayton, Springfield & Urbana Southwestern Railway Company, of Springfield, has been incorporated with $250,000 capital stock by Jonathan S. Harshman, James F. Mahoney, Frederick R. Green, Charles A. Ackerman and John G. Webb. It proposes to build an electric road from Springfield to Yellow Springs, Cedarville, Xenia, Jamestown and Clifton.

BUCYRUS, OHIO.—The stockholders of the Buckeye Traction Company, recently incorporated, have elected the following officers: R. V. Sears, president; C. Feiring, vice-president; W. A. Blicke, secretary-treasurer. The above, with S. J. Kibler, A. J. Scott and H. V. Flickinger, constitute the board of directors. Right of way is being secured between Bucyrus, Sulphur Springs, New Washington, Shelby and Norwalk.

LEGAL.

SPRAGUE CONTROLLERS IN BOSTON.—In the United States Circuit Court last week Judge Colt heard a motion in the case of the Thomson-Houston Company against the Boston Elevated Railway Company. The plaintiff had filed a motion seeking an injunction to restrain the defendant from using a controller alleged to be protected by patents held by it. The railway company asked the court to dismiss the motion of the plaintiff on the ground that it did not contemplate using a controller protected by the plaintiff's patents, and should not be put to the expense and trouble of making a defense with regard to the use of any other or different system of equipment than which it proposed installing. It produced an affidavit from G. H. Hill, electrical engineer of the Sprague Electric Company, which has the contract for the equipment of the Boston Elevated road, explaining the Sprague multiple unit system, which is to be used by the road. Mr. Hill said the system would contain no such controller as that on the Brooklyn Heights Railroad, which has been enjoined by Judge Lacombe of New York, nor any controller wherein a motor connecting switch and rheostat switch are mechanically connected, but, on the other hand, it would contain one in the form adopted in accordance with the terms of the contract with the elevated road. Judge Colt allowed the motion of the defendant. F. H. Betts, of New York, appeared for the plaintiff, and C. A. Mitchell, of New York, for the defendant.

OBITUARY.

MR. W. R. LEHMICKE, secretary and treasurer of the Hot Springs, Ark., Electric Light, Water & Gas Company, died on Jan. 31.

MR. F. H. TWITCHELL.—We regret to note the death, on Feb. 5, of the Hon. Fritz H. Twitchell, well known in Bath, Maine, as a former mayor, etc., and one of the large holders of stock in the Bath Gas & Electric Company.

PERSONAL.

MR. E. P. BURCH, consulting engineer, gave a lecture on "Electric Railways" to the class in that subject at the University of Minnesota on Feb. 14.

PROF. GEO. D. SHEPARDSON, of the University of Minnesota, will read a paper on "Electric Lighting of Trains" before the St. Louis Railway Club March 8 next.

PROF. ELIHU THOMSON has favored the Lowell Institute, Boston, with two lectures on electric undulations, accompanied by experimental demonstrations, etc.

DR. M. I. PUPIN is to lecture before the Franklin Institute on Feb. 20 on the subject of "Electrical Wave Propagation," which he has made peculiarly his own for some time past.

MR. ROBERT HUTCHIN JEFFREY, of Columbus, Ohio, general manager of the Jeffrey Manufacturing Company, was married on Feb. 6 to Miss Alice Kilbourne, of Columbus.

PROF. F. B. CROCKER lectured on Feb. 15 before the Department of Electricity of the Brooklyn Institute on "The Meaning of the Most Important Electrical Terms." The lecture was illustrated by experimental demonstrations.

MR. S. G. McMEEN, chief engineer of the Central Union Telephone Company, Chicago, Ill., will lecture before the engineering students of Purdue University, Lafayette, Ind., on Feb, 27, his subject being "Modern Developments in Telephony."

MR. F. HIRD, B. A., and Mr. R. Dumas, A. M. I. M. E., of the English house of Siemens Bros. & Company, Ltd., have arrived from London and are making a month's tour around the country in order to acquire some idea of America's methods at first hand. They are greatly pleased with what they have seen already and hope to make as thorough an inspection as their short stay will allow.

PROF. ALEXANDER GRAHAM BELL has been serving as a special agent of the Census Bureau in charge of the enumeration of the deaf, dumb and blind population of the country, and is now preparing his report. Mr. Bell is very wealthy, but is entitled to $6 a day from the Government while he is employed in this work. A large part of his life has been spent in the investigation of means for promoting the education of deaf-mutes and sightless people.

MR. JAMES MITCHELL, of Rio Janeiro, and one of the leading dealers in electrical machinery in South America, is now in New York for the purpose of placing several contracts relating to electrical equipment and appliances required for various plants in Brazil. Mr. Mitchell, who expects to be in the United States for about 10 days, is making his local headquarters at the offices of the Flint-Eddy & American Trading Company in the Johnson Building, Broad Street.

LIEUT. J. WILSON.—"Jack" Wilson, a veteran of the Klondike, who has been made a lieutenant of Gen. Kitchener's Body Guard, has had a remarkable career. He is only 33 years old, began life as a telegraph messenger in London, became an operator, studied law, and was made a solicitor. During the gold boom in Australia he was Mayor of Kalgoorlie. He afterward went to the Klondike. On the outbreak of the war he joined the Light Horse as a trooper and was twice invalided. He is now commissioned as a lieutenant.

PROF. D'ARSONVAL, in lecturing in Paris on liquid air last week said: "I know that apparatus has been constructed in America and I have models of it at home, but I continue to assert that liquid air cannot be utilized in running motors because they produce only 5 per cent of the force spent in producing liquid aid. Such motors can only be used in laboratories or in floating companies to drain the money of silly people or for submarine boats, where expense is of no consequence. Regarding the utility of liquid air, the German savant Linde shares my views." He spoke very favorably of submarine boats.

MR. T. G. SEIXAS, vice-president and superintendent of the Germantown Electric Light Company, Philadelphia, Pa., was very quietly married on Thursday, Feb. 14, to Miss Amelie L. Bunont. The wedding took place at the home of the bride's mother, 6 West Thirteenth Street, New York City. Mr. Seixas was for years associated with Mr. Thos. A. Edison at that gentleman's laboratories and mines, but for the past four or five years has been connected with the Philadelphia Electric Company as vice-president and superintendent of the Germantown Electric Light Company. Mr. Seixas' many friends unite in wishing the young couple a happy and prosperous future. Mr. and Mrs. Seixas, upon returning from their wedding trip through the South, will reside in Germantown, Philadelphia.

MR. GARDINER C. SIMS, who has of late been engaged on important work for the United States Navy, including lately the supervision of steam equipments on the new transports, has decided to return to the commercial field, in which his name was made and where his reputation stands high as that of one of the foremost American exponents of modern steam engineering. He has become a stockholder in, and superintending engineer of, the William A. Harris Steam Engine Company, of Providence, R. I., builders of the Harris Corliss engine, who will now also, under his direction, build the improved version of the famous Armington & Sims engine with which incandescent lighting began its successful career in America. Mr. Sims has been residing in New York to discharge his official duties, but will be found this summer at his charming country home on Narragansett Bay. Mr. W. F. Haring will represent the new interests, as formerly the old ones, in New York City, where Mr. Sims will fortunately be a frequent visitor. We know of hardly any event in the steam field which could give as much pleasure to the electrical community as this return of Mr. Sims to his former engineering work.

Trade Notes.

THE MILWAUKEE ELECTRIC COMPANY, Milwaukee, Wis., has been authorized to increase its capital stock to $150,000.

OIL FILTERS IN FINLAND.—The Burt Manufacturing Company, Akron, Ohio, has just shipped six Cross oil filters to Finland.

CHANGE OF NAME.—The title of the Wolfe-Lovett Construction Company, Omaha, Neb., will be changed to Wolfe-Lovett Electrical Company.

THE WESTERN ELECTRIC COMPANY, Chicago, is carrying a large line of construction material of use to central station and street railways. Bulletins of this material are being sent out.

CHAS. WESLOW, Warren Street, Harrison, N. J., conducts a business of buying broken and defective incandescent lamps and selling renewed lamps. His business is neatly illustrated in a little calendar just issued.

THE AMERICAN ELECTRIC FUSE COMPANY, New York and Chicago, has issued a neat little calendar containing a colored picture of two hungry pigs. The legend underneath tells what they are after, and what the company is after.

THE HIRSCH-VOTH MANUFACTURING COMPANY, Milwaukee, Wis., is manufacturing small power motors and dynamos. The company's specialty is a small dynamo for gas engine ignition for automobiles, and several good orders have been received.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is sending out literature describing Adams-Bagnall arc lamps. These lamps are made in seven different styles and for alternating, direct current, constant potential and direct constant current series and street railway work.

ASBESTOS PRODUCTS.—Asbestos papers, packings, mill-boards, etc., constitute the subject of a little pamphlet issued by the H. W. Johns Manufacturing Company, New York. Those concerned in these lines of goods will find much of interest in this pamphlet, copies of which may be had on application to the company's office.

BARGAINS IN AUTOMOBILES.—The St. Louis Automobile & Supply Company, Twenty-third and St. Charles Streets, St. Louis, Mo., is sending out a lot of literature pertaining to second-hand automobiles and automobiles complete and parts of the same. Every one interested in this class of vehicles might find it to his interest to communicate with the company.

LAUFKETTER & BENDIT, of St. Louis, long favorably known as a mechanical supply house, have added an electrical department to their business, with Mr. Louis E. Fischer in charge. Prominent among the manufacturers they will represent in that section are the Onondaga Dynamo Company and the Syracuse Electric Instrument Company, both of Syracuse, N. Y.

THE SUBMERGED ELECTRIC MOTOR COMPANY.—In our issue of Feb. 2 appeared an item about this company being ready to proceed with the manufacture of its apparatus, after preliminary experimental work. It was there stated that the company's headquarters were at Menomonee, Mich. This location, we are informed, is an error; its headquarters are at Menomonie, Wis.

FIRE.—On the evening of Feb. 9 fire visited the factory of W. R. Ostrander & Company, in Brooklyn, N. Y., and did some damage, although it was not as great as was reported in the daily papers. The firm expects to have everything running again in a very short time, and as it had a large stock of goods on hand in its New York store rooms, it is in position to fill all usual orders without delay.

BUSINESS CHANGE.—Messrs. Percival & Jones, mechanical and electrical engineers, 211 North Seventh Street, St. Louis, Mo., notify us that they have purchased the entire stock and instruments of the late Geo. J. Percival and will continue business at the old headquarters. The business of this firm is that of writing specifications, drawing up contracts, superintending work in the course of construction, etc. The members of the firm are Isaac W. Percival and Houston Jones.

GRAPHITE AS A LUBRICANT.—In a 44-page booklet of the Joseph Dixon Crucible Company, Jersey City, N. J., is given much information on the use of graphite as a lubricant. The subject is scientifically and practically considered, and its manifold uses as an accessory for engineers and mechanics are pointed out. This is the seventh edition of this work and is revised to date. The company will be glad to send a copy of the pamphlet to any one interested in better lubrication.

RAILWAY MOTORS.—The Westinghouse Electric & Manufacturing Company has issued two circulars, Nos. 1038 and 1039. The former describes and illustrates the Westinghouse No. 49 railway motor and the latter the Westinghouse No. 38B railway motor. The No. 49 motor is one of the company's standard motors for medium speed, city and suburban work, and the 38B motor is suitable to the conditions ordinarily met with in commercial service where a high power motor is required.

MEDBERY INSULATION.—H. M. Shaw & Company, 115 Broadway, New York, manufacturers of Shaw's non-arcing lightning arresters, have secured the exclusive management and control of the Medbury insulation, well and favorably known to the street railway trade. The firm will have the exclusive right to manufacture this insulation. It is now in a position to supply promptly all the designs of the Medbery overhead material, which is in use on many of the large street railways in the United States and abroad.

MR. WILLIAM B. LYNCH, 101 Beekman Street, New York, has been engaged in pattern and model making for the past 15 years. For a year and a half of that time he was engaged entirely in electrical work and has therefore wide and thorough familiarity with the parts that go to make up electrical machinery and supplies. He has just opened an office at the foregoing address, where he is prepared to undertake pattern and model work, paying a great deal of attention to—in fact, making a specialty of—electrical work.

TELEPHONE CATALOGUE.—The Bruckner Electric Company, 141 East Twenty-fifth Street, New York, is manufacturing a full line of telephones and telephone equipments. In a 24-page pamphlet just issued the company describes and illustrates its desk instruments, intercommunicating system, switchboard system, automatic release intercommunicating telephone system, its new adjustable telephone arm without connection cord, and its transmitter. At the back is given a long list of individuals and concerns using the Bruckner apparatus.

RHEOSTATS AND CIRCUIT BREAKERS.—Messrs. Geipel & Lange, Parliament Mansions, Westminster, London, Eng., are sole agents for Great Britain and France for Ward Leonard rheostats and circuit breakers. We have received from this firm a copy of its 64-page catalogue devoted exclusively to the subject of these devices. The list includes over 700 different articles, each one being specially designed and constructed for the duty mentioned. Messrs. Geipel & Lange keep in stock a large number of these devices in most common use for early delivery.

THE GARTON-DANIELS COMPANY, of Keokuk, Ia., so well known in connection with the Garton lightning arresters, is now making a name for itself among the telephone people as manufacturer of extension circuit devices, the merits of which seem to have attracted the attention of many of the most prominent telephone companies in this country. As a result it is getting inquiries and orders for them that are very encouraging. It publishes a little eight-page pamplet on the subject of extension circuit devices which is well worth perusing by every telephone man and which may be had for the asking.

GUY ANCHORS.—In a booklet issued by W. N. Matthews & Bro., St. Louis, Mo., the Stombaugh guy anchors are illustrated and described. These anchors are used for anchoring telephone poles, telegraph poles, street railway poles, electric light poles, fences, smoke stacks, etc. This anchor resembles a large auger and is screwed into the ground, being left there. It saves much time and labor and avoids digging, filling, tamping, etc. It is made in six sizes; the smaller sizes are put into the ground with a hollow wrench keyed to fit them, and the larger sizes are put in by using their own shank as a wrench.

THE COLONIAL ELECTRIC COMPANY, of Ravenna, Ohio, is reported to be enjoying the largest business in its history. The number of lamps shipped the first month of this year exceeded that of any previous month by about 15,000. The average monthly shipment is about 75,000. There is considerable rivalry between the vacuum pumping departments of the Ravenna and the Warren plants. Until recently an employee of the Warren plant held a record of 1265 lamps in one day. A few days ago Miss Orpha Thomas, of the Ravenna plant, pumped 1400 lamps in 10 hours, which is considered a remarkable day's work.

PAN-AMERICAN EXPRESS.—A folder containing maps, and profusely illustrated—the latest of the "Four-Track Series"—has just been issued by the New York Central & Hudson River Railroad Company. A large amount of its space is devoted to the Pan-American Exposition. It contains interesting facts about Buffalo and the Exposition. An interesting and astonishing fact is pointed out on a map. It is shown that a circle with Buffalo as its centre, and with a radius of 500 miles, has within its limits more than one-half of the entire population of the United States, and more than three-fourths of the entire population of Canada.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that its factory is fully engaged in the manufacture of Emerson desk and ceiling fans for the season of 1901 and that the demand for Emerson apparatus has necessitated a considerable increase in factory facilities and additional machinery. In order to make the desk fans with the special hardened steel shaft that has been used by the Emerson Company for some years past, very accurate, expensive machinery is necessary, and the company has recently received from the Brown & Sharpe Manufacturing Company, of Providence, R. I., a grinding machine which was made specially by it as a part of its exhibit at the Pan-American Exposition.

RECORDING GAUGES.—Messrs. Schaeffer & Budenberg, Brooklyn Borough, New York, call attention in a leaflet to their Columbia and Metropolitan recording gauges. The Columbia gauge is adapted for recording pressures of steam, water, gas, air, also vacuum, and may be placed near the boiler or at any distance therefrom. The Metropolitan gauge is adapted for both indicating and recording pressures of steam, water, gas or ammonia and hydraulic; also vacuum. Besides the apparatus mentioned, the firm manufactures tachometers, indicators, planimeters, reductors, calorimeters, steam whistles, etc. The exhibit of this firm at the Paris Exposition of last year was awarded three gold medals and one silver medal.

THE DOUBLEDAY-HILL ELECTRIC COMPANY, of Pittsburg, has been enlarging its business and branching out very extensively, until at present it is carrying constantly the largest stock of any electrical supply house in the country, with the exception of one or two. It is exclusive representative in its territory for the Adams-Bagnall Electric Company, Emerson Electric Manufacturing Company, Hart Manufacturing Company, H. W. Johns Manufacturing Company, Phillips Insulated Wire Company and Sprague Electric Company, besides carrying the lines of a number of other electrical manufacturers. It has just issued a catalogue for 1900, consisting of 240 pages, profusely illustrated, showing the lines which it carries, with prices and all other necessary particulars. This catalogue shows its line to be full and complete. It is bound in heavy cloth boards and is a handy reference for the desk of any one who purchases electrical supplies frequently.

MR. I. P. FRINK, of 551 Pearl Street, New York, has just completed the installation of lighting fixtures for the Second Church of Christ, Sixty-eighth Street and Central Park West, this city. This church is almost entirely lighted by concealed lamps backed by powerful reflectors that throw all the light upon the large domed ceiling, which again reflects and diffuses the light all over the church. The Frink name has been identified for nearly half a century with successful church lighting by reflecting chandeliers and prismatic sun-lights, but this method as applied to churches is comparatively new, though it has been most successfully used in fine ball rooms, concert halls, banquetting rooms, etc., where a soft and perfectly diffused, but at the same time strong light is required by the scheme of decorations. Mr. Geo. Frink Spencer, manager of the Frink business, who has made a specialty of this method of lighting, has been frequently consulted by leading architects and electrical engineers, and has been commissioned to devise and execute the fixtures for some of the finest interiors in New York.

REMOVAL.—The San Francisco Electrical Works, H. P. Thayer, manager, recently removed to 523 Mission Street.

THE COLONIAL ELECTRIC COMPANY, Ravenna, Ohio, manufacturer of the Orient and Colonial incandescent lamps, is sending out a calendar for the new year. The card contains an interesting picture.

MILLING MACHINES.—The Becker-Brainard Milling Machine Company, Hyde Park, Mass., gives a description and illustrations of its No. 5B plain horizontal milling machine, in a pamphlet just issued. The dimensions of the machine are given in a table.

PUSH-BUTTON SWITCH.—The General Incandescent Arc Light Company, New York, has issued a bulletin on its new push-button switch. This device is illustrated. The bulletin also describes and illustrates an attaching plug and flush receptacle with outlet box for wall, floor or surbase; also the new G. I. 100-ampere triple-pole automatic switch.

THE MILWAUKEE ELECTRIC COMPANY, Milwaukee, Wis., has moved into new office quarters in order to furnish much-needed room in the factory. The company reports business as very flourishing and has closed a contract with the Locomobile Company of America, Hartford, Conn., for a 225-kw generator and several motors for the complete installation equipment.

THREE CARS OF MOTORS.—One of the largest shipments of electric motors ever received on the Pacific Coast recently arrived in San Francisco. The motors were manufactured by the C & C Electric Company of New York for the Mutual Label & Lithograph Company and are now being installed in the immense press rooms of the company's new building. The shipment filled three cars.

CENTRIFUGAL PUMPS.—A very complete line of centrifugal pumps is shown in a 52-page catalogue of the Lawrence Machine Company, Lawrence, Mass. These pumps are designed for water supply, irrigating and draining land, pumping out coffer-dams and excavations, dry docks, and for use in all places where a large body of water has to be elevated to a moderate height, quickly, cheaply and efficiently. Each illustration is accompanied by a table of dimensions of the various sizes of the class thus represented. Several electrically driven pumps are also illustrated.

TELEPHONE OF NEW DESIGN.—The Central Telephone & Electric Company, St. Louis, Mo., is putting on the market a telephone of new design. The feature of the instrument is that it presents a handsomer appearance than the ordinary telephone and is easier to operate. The generator, being placed in a box just below the desk, is on a level with the arm. Ordinarily these relative positions are reversed. The company believes that the new design will meet with considerable demand. The working parts of the instruments are of the best throughout.

THE NORTHWEST FIXTURE COMPANY, Seattle, Wash., has made an arrangement whereby, on Jan. 1 last, it became selling agent for Partrick, Carter & Wilkins, of Philadelphia. The arrangement is such that the Fixture Company's plant practically becomes a part of the factory of the Philadelphia firm. It will carry in Seattle a large stock of Partrick, Carter & Wilkins goods. The company has greatly increased its stock of electrical supplies, covering everything from an engine to a push button. It has a purchasing department and a warehouse in New York, at 26 Cortlandt Street. The Western house of the Northwest Fixture Company is drawing on its warehouse stock of electrical supplies to the extent of about one car load a week.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED FEB. 12, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

667,666. CALENDERING MACHINE; D. Beswick, New York, N. Y. App. filed Feb. 21, 1900. An electrical heater is arranged inside of a calendering cylinder in such a way as to uniformly heat the surface thereof.

667,727. AUTOMATIC ALARM SYSTEM; F. McGloin, New York, N. Y. App. filed May 21, 1900. A phonograph is connected with a telephone circuit so as to send in a fire or other alarm by automatically sending an articulate message over the line.

667,728. TALKING MACHINE; F. McGloin, New York, N. Y. App. filed June 6, 1900. Relates to the preceding, the phonograph being adapted to repeat the message a number of times.

667,729. ELECTRIC BRAKE MECHANISM; Frank C. Newell, Chicago, Ill. App. filed Aug. 26, 1899. When the track brake operates, the wheel shoes are thereby also set. The magnet is magnetically insulated from the wheel shoes.

667,730. ELECTRIC BRAKE: Frank C. Newell, Wilkinsburg, Pa. App. filed May 2, 1900. The operation of the rail shoe also sets the wheel shoes. Mechanism in compact form for application to a multiple truck.

667,764. ELECTRIC SWITCH; D. R. Bruce, London, Eng. App. filed July 28, 1900. Details of a quick-acting switch.

667,805. SIGNALING APPARATUS; W. A. Swaren, Chicago, Ill. App. filed Jan. 2, 1900. A plurality of contacts corresponding respectively to railway switches or other devices to be controlled, are so arranged that an alarm or signal cannot be sounded until all of said contacts are moved to their proper position.

667,859. SHIP'S TELEGRAPH; F. W. Wood, Newport News, Va. App. filed July 11, 1900. The reversing shaft of the ship's engine is arranged to automatically repeat the signal sent to the engine room from the bridge.

667,882. FEEDER WIRE INSULATOR; C. K. King, Mansfield, Ohio. App. filed Dec. 10, 1900. Details.

667,889. ELECTRIC SPARK COIL; S. B. Morss, Rahway, N. J. App. filed March 21, 1900. The coil is hollow and carries a battery inside thereof.

667,903. TROLLEY SWITCH; C. P. Cornell, Baldwinsville, N. Y. App. filed June 29, 1900. Details of an overhead switch.

667,904. CLOSED CONDUIT ELECTRIC RAILWAY; L. Dion, Boston, Mass. App. filed Aug. 6, 1900. The flexible conductor deposited in the roadbed lies a considerable distance below the surface, but has upwardly extending loops reaching into boxes which come within the influence of the magnet carried by the car, to be lifted to make the necessary contact.

667,958. ALARM APPARATUS; R. Segerdahl, Chicago, Ill. App. filed Sept. 2, 1899. This is a bell in which the mechanism is attached to what is usually the cover, the back plate being omitted.

667,966. ELEVATED ELECTRIC RAILWAY; L. A. Brown, St. Louis, Mo. App. filed Oct. 22, 1900. Details of construction of a single rail overhead system, in which the motors are disposed below the platform and on each side of the single rail.

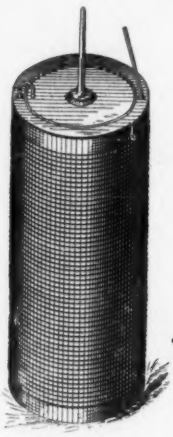
667,980. TERMINAL SOCKET; E. W. G. C. Hoffman, Charlottenburg, Germany. App. filed Oct. 11, 1899. The socket is divided longitudinally so that the contact parts can be readily inserted, after which the parts are clamped together by means of screws.

667,996. TRANSFORMER; F. Schwedtmann and W. A. Layman, St. Louis, Mo. App. filed June 1, 1900. The insulation which separates the coils from each other is provided with conduits for the circulation of air, oil or other insulating or cooling fluid.

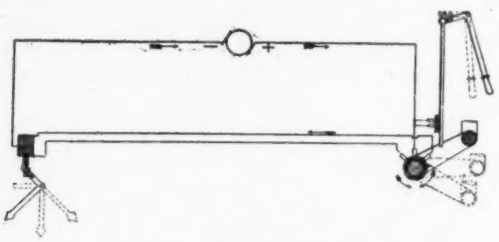
668,022. SIGNAL CONTROLLING RELAY; H. E. Shreeve, Dedham, Mass. App. filed Oct. 1, 1900. A special form and winding of two-coil relay for telephone systems.

668,030. MEANS FOR STOPPING ELECTROMOTORS; J. J. Wood, Fort Wayne, Ind. App. filed Oct. 15, 1900. A magnet for a motor controller adapted to remain inactive during the normal range of current vibrations, and to respond to either a minimum or maximum current, having a double winding comprising a series coil and a shunt coil wound to receive currents in like direction so as to co-operate in the magnetization of said magnet, whereby the magnet will act as an underload magnet so long as a magnetizing current continues in either of said coils.

668,044. TELEPHONE SWITCHBOARD AND CIRCUIT; F. L. Gilman, New Bedford, and C. H. Herzig, Boston, Mass. App. filed Nov. 6, 1900. Small sub-stations having a number of lines running to central, have one of these lines connected to a socket in the usual space on the switchboard, in front of the operator, while the other lines run to sockets in a special space on the switchboard. The first socket carries a distinguishing sign, adjacent to it, which indicates that there are other sockets connected with the same sub-station in the special space. When a call for the sub-station comes in, the operator tests the regular socket first; if that is busy, she then tests in succession the other sockets in the special space, until one not busy is found. This avoids the usual wide distribution of the sub-station sockets throughout a multiple board.



667,889.—Electric Spark Coil.



667,859.—Ship's Telegraph.

668,142.—Wire Splicer.

668,108. TRANSFER APPARATUS FOR ELECTRIC BATTERIES; C. O. Mailloux, New York, N. Y. App. filed Dec. 29, 1899. (See Current News and Notes.)

668,109. STORAGE AND TRANSFER SYSTEM FOR ELECTRIC BATTERIES; C. O. Mailloux, New York, N. Y. App. filed April 24, 1900. (See Current News and notes.)

668,140. RHEOSTAT AND CIRCUIT BREAKER; H. B. Cutter, Philadelphia, Pa. App. filed Feb. 24, 1899. A spring actuated resistance controlling switch, electromagnetic means for normally restraining the same, and an automatic magnetic circuit breaker, the coil and switch of which carry the motor actuating current.

668,142. WIRE SPLICER; E. Figueredo, New York, N. Y. App. filed July 20, 1900. A wire splicer, consisting of a pair of wire-grasping jaws, and an intermediate connecting bar arranged below the same, and combining therewith to form a recess open at both sides, whereby unobstructed access may be had thereto.

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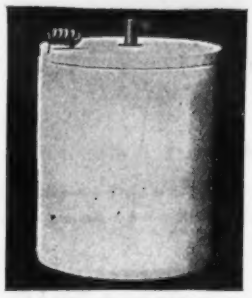

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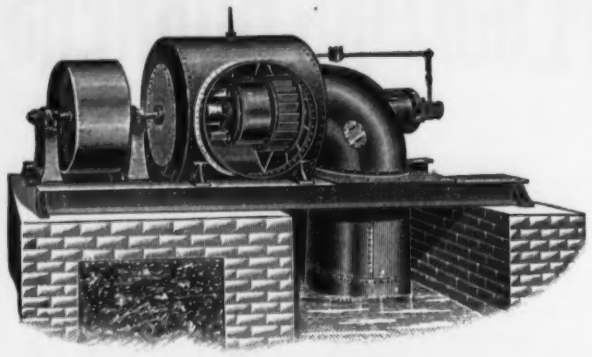

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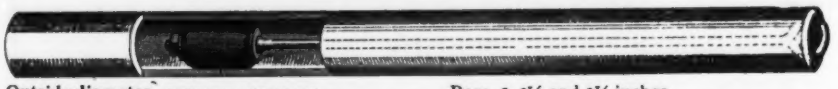

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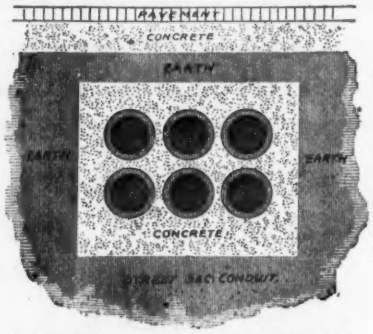

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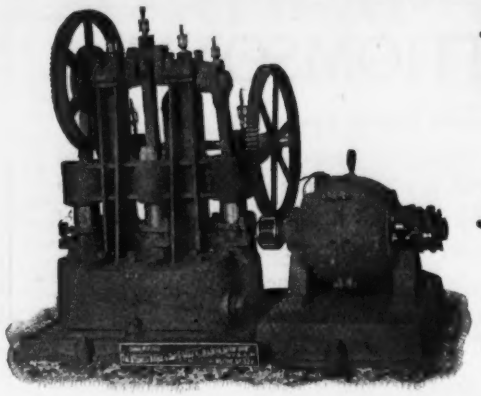

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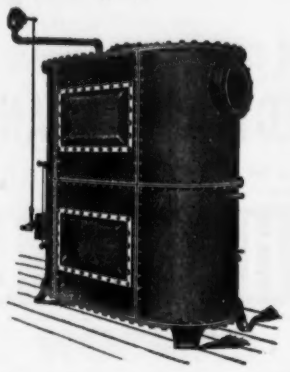

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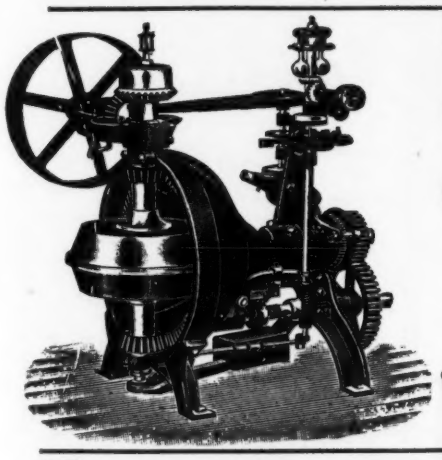

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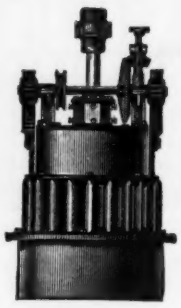

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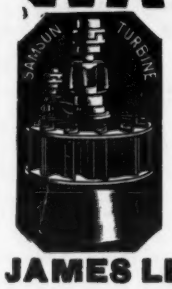

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